The Chemical Age

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NOTICES :—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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Technical Applications of Electricity

OUR issue this week is devoted more specifically to some of the many technical applications of electricity. The chemical engineer can, in a broad sense, regard electrical apparatus from two standpoints, namely, as a convenient but not necessarily cheap motive power for such things as mechanical handling plant, hydro-extractors, and centrifugators; and, secondly, in connection with recording instruments and the like, the operation of which is dependent upon electrical principles. In our special number of January 29 we devoted some considerable attention to the application of electrically driven machinery in chemical works, and in our present number consideration is given primarily to thermo-electric and electro-chemical subjects. To take an example, the science of thermo-electric pyrometry has been developed enormously during the past decade, so that, whether for accurate research work or the gauging of ordinary operations, instruments of proved reliability are now to be obtained. This subject in itself is an involved science; and, perhaps, no better illustration of its complexity is needed than the mass of information which was unfolded some two years ago at a special meeting which the Faraday Society held in order to discuss it. Many will agree with us in saying that the published proceedings of the Faraday Society provide the most complete record of pyrometrical conceptions extant.

One of our contributors deals with ozone and triatomic hydrogen, known as "hyzone." In pointing to the romantic career of ozone, he reminds us that, although the technical application of hyzone appears to be remote, it is to-day a chemical individual, even though it has not been isolated from hydrogen. Certainly, it possesses several properties which render its industrial use difficult, and the main problem is its tendency to revert to the di-atomic state. Were stability effected, however, it does not require much imagination to realise that, in the synthesis of ammonia, catalysts could be dispensed with, and ordinary temperatures employed. As to ozone, although its present applications may not be extensive, they are eminently useful, and it seems probable that the near future may see it employed in newer directions, such as an antiseptic in surgery, in the preservation of foodstuffs, or even for giving "age" to wines. At the moment, one of its most extensive uses is in connection with water sterilisation, although it would seem that in this direction it is likely to find—from the point of economy—a stubborn competitor in chlorine. Again, in its role as a medium for the purification of air, ozone is well known to those whose daily itinerary takes them into the bracing atmosphere of the Tube railways.

Chemists' Salaries

THE Institute of Chemistry may be congratulated on the excellent work it is doing to improve the salaries and conditions of qualified chemists. In reply to a recent circular issued on this subject it has received replies from 917 chemists (including 25 women) resident in Great Britain and Ireland, of whom 616 were Associates and 301 Fellows. Seventy replies were also received from chemists employed in Overseas Dominions. From these returns figures have been obtained showing the present average rate of pay received by Fellows and Associates at the age of 30, compared with that received in 1919, to be as follows :—

	1919	1920				
In Industry	...£410	£525	with annual increments of			£24
,, Govt. Service	...£350	£450	,,	,,	,,	,, £15
,, Teaching Work	£285	£390	,,	,,	,,	,, £15
,, all branches	...£380	£480	,,	,,	,,	,, £22

That the Fellowship of the Institute has a material as well as academical value is proved by the fact that at the age of 30, for example, the average salary of Fellows in whole-time appointments generally is about £550,

in industry £590, in Government service £510, and in teaching £440.

As regards chemists engaged in industry returns were received from 637 members, nearly all under 50 years of age. It is satisfactory to learn that they mark a considerable improvement on those of the previous year; the average salary has increased, age for age, by sums varying from £90 to £140, while actual dissatisfaction is seldom expressed. Though little complaint is made of harshness in terms, cases are reported where chemists are unable to secure their proper status, where they are subject to illogical restrictions, or are rigorously debarred from opportunities of showing initiative in applying their knowledge to the best advantage. In at least one such case it is clear that the worth of the chemist is deliberately denied adequate recognition for fear of creating jealousy in the non-technical staff. On the other hand, the majority of industrial chemists are looked to for the suggestion of improvements in operations and management, and are frequently rewarded either by lump sum payments, by a bonus on profits, or by allotment of shares in the company, or are definitely permitted to exploit their own inventions.

The case of the chemist employed only for purposes of research is found to be somewhat different, as the search for improvements is the sole reason for his employment. Some chemists take the view that they cannot properly claim additional consideration when their researches prove unexpectedly remunerative to their employers, since they or others may do equally good work for months, or even years, obtaining results negative in character, which are not translatable into monetary values. Others, however, feel that they should receive a special award for any discovery they may make, and the returns show that many research chemists are given a financial share in royalties from patents which are utilised by others than the employing firm, and even for those worked by the employing firm after the expiration of their agreements. Many contracts contain a clause restraining the chemist from practising in a similar branch of industry for a definite period. Generally the time and area of restraint are considered reasonable, varying from one to three years, and within small defined areas. Instances occur, however, where perpetual and almost world-wide restraint is attempted. The question of the publication of scientific work is variously treated. Some firms, it is stated, are apparently unduly secretive and forbid any publication; but while admitting that occasionally a firm may have good ground for concealing a discovery from its competitors, such a course imposes hardship on chemists when they are not allowed to submit records of their work as theses for doctorate degrees of the Universities, or as evidence in support of their claims for the Fellowship of the Institute.

The improvement in the position of chemists engaged in Government Service is reported to be due largely to the award of the recent Civil Service bonuses, and it has in some cases arisen through the reorganisation of the departments concerned. The hours of working and periods of leave are, on the whole, more favourable than in industry, and no return shows evidence of discontent on that account, but some are doubtful as to prospects of promotion, especially holders of temporary appointments, who are desirous that their positions should be placed on a permanent footing. Only 45 returns were received from chemists engaged in whole-time municipal or other public employment. Whereas in one or two appointments the conditions compare favourably with those in Government Service, the average salary is about £50 lower. The figures for teachers of chemistry, though comparing unfavourably with those of other branches of the profession, show considerable improvement upon those published last year. Moreover, the position at the time the returns were received was not so favourable as it is to-day, since many authorities have now adopted the recommendations of the Burnham Committee. The average rate of pay of women Fellows and Associates is in every case less than the average received by men of the same age. Similarity of treatment is more nearly accorded in Government Service where younger women chemists receive only 3·7 per cent. less than the average salary of men in the same grade. In industry women start at a disadvantage of about 15 per cent., and this is increased with increasing age. Teaching posts for women are also less remunerative to the extent of 6·30 per cent. The general position at present seems to be that women chemists are paid a slightly lower initial salary than men, and their prospects of promotion are much more limited.

Stabilising the Exchanges

Mr. C. W. Dare, who is closely associated with the chemical and pharmaceutical industries of the United States, has spent three months in investigating industrial conditions and prospects in Europe. In a careful summary of his conclusions, contributed to *Drug and Chemical Markets*, he singles out the present discrepancy between American and European exchanges as the chief obstacle to the development of United States trade. European chemical industries, in view of the favourable rate of exchange, are willing enough to sell to the United States, but for the same reason are prevented from buying from the United States the raw materials needed. From the American point of view this is a serious matter for their chemical industries, many of which have been enormously developed during the war. For example, it is claimed that the United States coal-tar industry, in the number and value of its plants as well as in the tonnage of its output, exceeds the German. The result of this growth is that the domestic chemical market in the United States has reached the saturation point, and that manufacturers must either increase their exports or restrict their production.

When it comes to remedies, Mr. Dare looks to Germany, which he describes as "the workshop of Continental Europe," as the key. "If," he says, "the mark were raised to a parity with the French franc, for example, active trading would be possible on equal terms between Germany, France, Italy, Belgium, and the Scandinavian countries. The exchange of various crude materials and finished products could in this way be effected. A balance would soon be established which would raise the exchange of all of these countries gradually to a parity with Spain, Switzerland and Great Britain. In other words, by working from the bottom up, the whole scale of foreign exchange would gradually be raised to a position closer and closer to the international value of the dollar. As to

remedies, two are mentioned. The first is that Germany should have credits for purchasing raw materials in order to resume her industrial activities. The second is that the German people must know definitely what war indemnity they must pay and upon what terms. It is clear, in any case, from all this that the development of trade between the chemical industries of the United States and Germany will not be hampered by any sentimental antagonism on the American side.

Defending the Merchant

THE Chemical and Dyestuff Traders' Association has taken up with the Profiteering Act Central Committee an interesting point affecting the position of the merchant. There has been a feeling for some time that the official element which got so much control over trade during the war still clings affectionately to its authority, and as if to show the dreadful extent to which the "middleman" preys upon the public an elaborate table has been prepared showing how a certain commodity passed through twelve hands before it reached the consumer. One fancies that many tables of an even more informing character could be prepared of the number of hands through which communications addressed to Government departments go before they reach the proper quarter. It is pointed out in this case that the Committee do not state what the commodity is—though it might easily be mistaken for soda crystals—where the transactions took place, or out of what total number this particular one was selected, while the date of the first transaction is entered as "unknown." Nor is it stated how much time, labour and taxpayers' money have been expended on the tabulation of this interesting form.

In a spirited reply the Association protest against the creation of prejudice against the trader and merchant by bringing out abnormal transactions from an abnormal period, and of basing large generalisations on isolated cases of this kind. Further, it is contended that the trader is on the average content with a margin of profit that makes him as a distributing medium far less costly, as he is certainly far more efficient, than any other means would be either to the maker or to the consumers. By "middleman" the Committee probably mean the speculator, who was largely a product of war conditions and whose activities the governing authorities did very little to control. The genuine merchant class would be only too glad to see him disappear.

Miall and Odling

Two distinguished and honoured figures in science have just passed away at ripe ages and with a noble record of work done. Dr. Odling, who had reached the age of 91, held for forty years the Waynfleete professorship of chemistry in the University of Oxford, and was known to successive generations of chemical students there. Dr. Louis Compton Miall, Emeritus Professor of Biology in the University of Leeds, was widely known not only for his strictly scientific work, but for his singular gifts of exposition as a lecturer and writer. He was linked with scientific and chemical interests through his two sons, in whom his high qualities of mind and character are happily perpetuated. On the day following Professor Miall's death his brother, Mr. J. M. Miall, died at Wimbledon, also at an advanced age. The week's obituary list further includes the name of Professor R. B. Clifton.

Recent Progress in Rubber Chemistry and Technology

NEXT week we shall begin the publication of a series of articles, specially written for the CHEMICAL AGE by Dr. Philip Schidrowitz, on "Recent Progress in Rubber Chemistry and Technology." The series will cover five issues, and readers who wish to ensure copies should order them in advance from the Manager, 8, Bouverie-street, E.C.4.

The Calendar

Feb. 21 to Mar. 4	British Industries Fair, 1921. 10 a.m.–6 p.m.	White City, Shepherds Bush, London.
Feb. 28	Royal Society of Arts: "Aplications of Catalysis to Industrial Chemistry," by Eric R. Rideal. 8 p.m.	John Street, Adelphi, London.
Mar. 1	Institute of Chemistry: Annual General Meeting	30, Russell Square, London.
1	Royal College of Science: Chemical Association: "Inter-Metallic Compounds," by N. R. Curtin. 4.30 p.m.	Royal College of Science, Dublin.
1	Hull Chemical and Engineering Society: "Ferro-Concrete in Practice," by T. Downs.	The Metropole, West Street, Hull.
2	Society of Public Analysts: Papers by C. A. Mitchell, G. Van Gilmour, S. H. Blichfeldt and T. Thornley	Burlington House, Piccadilly, London.
3	Chemical Society. 8 p.m.	Burlington House, Piccadilly, London.
3	Society of Dyers and Colourists (West Riding Section): "Chroming," by L. L. Lloyd	Yorkshire.
4	Royal College of Science Union, Chemical Society: "Chemistry and Disease," by J. H. Quastel	Royal College of Science, South Kensington, London.
4	Society of Chemical Industry (London Section) and the Institution of Mechanical Engineers' Joint Meeting: "Degassing and Purification of Boiler Feed Water," by Paul Kestner. 6 p.m.	Storey's Gate, Westminster, London.
4	Society of Chemical Industry (Manchester Section): "Column Apparatus for the Chemical Industry," by S. J. Tungay; "Normal Amyl Benzene and Some of its Derivatives," by L. Guy Radcliffe and N. Simpkin	Textile Institute, 16, St. Mary's Parsonage, Manchester.
5	Institution of British Foundrymen: "Some Experiences in Cupola Practice," by T. Pell. 4 p.m.	College of Technology, Manchester.

Books Received

THE PHYSIOLOGY OF PROTEIN METABOLISM. By E. P. Cathcart. London: Longmans, Green & Co., pp. 176. 12s. 6d. net.

RAPID METHODS FOR THE CHEMICAL ANALYSES OF SPECIAL STEELS, STEEL-MAKING ALLOYS, THEIR ORES AND GRAPHITES. By Charles Morris Johnson. Third Edition. London: Chapman & Hall, Ltd.; New York: John Wiley & Sons, Inc. Pp. 552. 36s.

ANTHRACENE AND ANTHRAQUINONE. By E. De Barry Barnett. London: Bailliere, Tindall & Cox. Pp. 436. 25s. net.

Ozone and "Hyzone" and their Technical Applications

A brief description is given of the development in our knowledge of Ozone, and of its use in industry. Triatomic hydrogen, "Hyzone," the results of the first chemical investigation of which have recently been reported in the "Journal" of the American Chemical Society, by Wendt and Landauer, is described, and the possibility of utilising its highly reactive nature in technology is considered. In the present state of our knowledge, it is true, this possibility is very remote, for the active hydrogen can only be produced in small concentration at, presumably, great cost, and very readily reverts to the diatomic form. Nevertheless, in view of many past experiences we should not be too precipitate in relegating "Hyzone" to the museum of chemical curiosities.

THE many interesting properties which are possessed by Triatomic Hydrogen, "Hyzone," the allotrope of Hydrogen corresponding to Ozone, the allotrope of Oxygen (compare Wendt and Landauer, *J. Amer. Chem. Soc.*, 1920, 42, 930-946), create a feeling of imaginative wonder as to the future technical possibilities of this substance. It is true that developments to anything like the same extent as have been possible in the case of Ozone can scarcely be looked for, in the present state of our knowledge—a point which will be developed later—but a recollection of the romantic career of Ozone bids us not be too dogmatic. The extent to which Ozone is used technically nowadays stands out in strong relief to its preparation in such limited quantities, even in comparatively recent times, when it was regarded almost as a chemical curiosity, to be prepared only in chemical laboratories. It was not until the later decades of the nineteenth century that efficient ozonisers of any reasonable works size were constructed, and it has been left to the twentieth century to see the economic utilisation of ozone in technology.

It is only about a century since Van Marum and later, Cruickshank noticed a peculiar odour in the vicinity of electrical machines, and it was not until 1840 that Schonbein investigated the question of this odorous gas, and showed it to be an allotrope of oxygen. The fuller investigations of Andrews and Tait, of Soret, of Brodie, and of others, by which the properties, reactions and constitution of ozone were thoroughly examined, need merely a passing reference here.

It is not proposed here to deal with the details of construction of present day ozonisers—almost invariably of the silent discharge type—nor to describe in detail the many applications which have been found for ozone. The proved uses of this body and its applicability as a "clean" oxidiser, will, however, be shortly referred to.

The Technical Applications of Ozone

Possibly the most recent potential use of ozone is in connection with the production of synthetic fatty acids from hydrocarbons. Harries has investigated the reaction of ozone upon the unsaturated hydrocarbons of lignite tar oil, and has succeeded in obtaining by their decomposition, a number of aldeydes and fatty acids, which, if they could be produced on an economic basis, would be capable of utilisation in industry. It is very unlikely, however, that the process can produce fatty acids in competition with those derived from natural sources, or from other synthetical operations, on account of the high power charges which would be incurred in the production of the large amount of ozone required per ton of fatty acids prepared. The end product too, is comparatively cheap, and, in this way, contrasts with certain fine chemicals, for example, vanillin, heliotropin, &c., which are now produced on a technical scale, by the use of ozone in the oxidation stage of their manufacture from iso-eugenol, iso-safrole, &c.

Large amounts of vanillin have been produced in this country for some considerable time, by the oxidation of iso-eugenol at the double bond, by means of ozone. The commercial success of the method speaks for its economy, and the ease of manufacture as compared with the oxidation by "chemical" means, together with the extreme simplicity and cleanly nature of the oxidation reaction, with consequently enhanced yields, have gone far to ensure and to further the use of ozone as a technical reagent. An ozoniser of the silent discharge type is used, and air is treated to emerge from the apparatus with an ozone content of about 2-3 gms. per cubic metre.

Water Sterilisation by Means of Ozone

One of the most extensive applications of ozone is in connection with the sterilisation of water. So long ago as 1886, the purification of water by the oxidising action of ozone upon the organic matter and pathogenic bacteria contained was in operation. Although it was found possible to carry out the process successfully the installation was not a commercially paying proposition. It was not until the development of more efficient types of large ozonisers, that the application of ozone in this direction became economically possible. At present, however, there are a large number of such purification systems in operation, chiefly on the Continent. It is, of course, doubtful if, in the future, there will be any extended application of ozone in this connection, for the advantages of the use of chlorine, which is so easily available and applicable, would seem to outweigh those of ozone, primarily from the point of view of cheapness, coupled with equality of satisfaction in use.

The process is very simple. The primary and almost the sole essential is to ensure an intimate contact between the ozonised air and the water to be treated. Many systems have been designed for effecting this, upon which it is unnecessary to dwell here. In brief, the ozonised air from a standard type of ozoniser, and containing about 2 to 2½ grammes of ozone per cubic metre of air, is brought into intimate and prolonged contact with the water to be purified. The time of contact is so adjusted that the air leaving the contact towers is free from ozone. It has been suggested to work with a much higher concentration of ozone and to re-pass the air, still containing ozone, after "re-strengthening."

The action of the ozone is, of course, merely that of an efficient oxidising agent. The organic matter is substantially destroyed, and the ammonia content is distinctly lowered. Pathogenic bacteria are entirely removed, and although the action of the ozone is selective, in that certain bacteria, for instance, B. Subtilis, are not killed, the treated water is satisfactory in every respect. It is advisable in many cases to give the water a suitable pre-treatment, leaving the ozone merely the duty of removing bacteria and certain organic matter, which are dangerous when the water is to be used for drinking purposes.

Somewhat in the same category is the use of ozone in the purification of air in confined spaces. Leaving out of consideration the discussions which have taken place from time to time as regards the minimum concentration of ozone necessary to be of service in the removal of dangerous germs from the inhaled air, and the effect of this concentration upon the respiratory system, it may be noted that a large installation of ozonisers is to be found in a London Tube system, and the results of the addition of ozonised air are beneficial.

The Treatment of Oils and Fats with Ozone

It is probable that in spite of the great amount of literature on the question of the deodorising and decolorising of oils and fats by means of ozone, no very extensive or universal application of the compound is made in this field. The main objection is undoubtedly that, whilst a fairly satisfactory deodorising or decolorising process can be operated using ozone, a better can result from the use of the so-called "bleaching earths," especially if a subsequent steam deodorisation treatment be applied.

A better result at a lower working cost is sufficient reason for the refusal to employ ozone, even if there are certain advantages associated with the use of the latter, in respect of ease of treatment, elimination of the filtration operation, and so on.

Nevertheless, many interesting results have been obtained. Especially is this the case with the use of ozone in the "thickening" of oils. The operation can be carried out at a lower temperature, and the colour of the oil is consequently the better.

In all these cases, it is scarcely necessary to state, that it is the oxidising activity of the ozone which effects the removal of colour or of odour, or assists in the reactions of oxidation which in part are responsible for the "thickening" of such oils as linseed and tung.

Other Applications

Ozone can be used in almost any case where a "clean" oxidation is required. It is unnecessary to elaborate upon this, or upon several of the uses to which ozone has been put from time to time. It will suffice to mention that ozone has been suggested for use in the artificial ageing of wines, in which process, since there must be many more reactions than simple oxidation, it is unlikely that any permanent use will be found. In the preservation of foodstuffs in combination with refrigeration there is a possible application, but figures are not available as to the cost of the quantities of ozone necessary to effect satisfactory preservation. Finally, ozone has been employed as an antiseptic in surgery, with a certain degree of success, but its extended application has not been reported.

Triatomic Hydrogen—"Hyzone"

Although the presence of triatomic hydrogen had been indicated prior to the work of Wendt and Landauer (Loc. Cit.), these authors first described experiments in which triatomic hydrogen was produced as a chemical individual, and in which the chemical properties of the substance were investigated.* The first indications of the existence of hydrogen in a triatomic state were obtained by Sir J. J. Thomson in 1913, when he allowed positively charged particles from a high-vacuum discharge tube, after simultaneous magnetic and electrostatic action, to impinge upon a photographic plate. Positive-ray analysis indicated the presence of particles of an atomic weight of three. These observations were confirmed later by Demster, Douane and Wendt again showed that hydrogen subjected to bombardment with a-rays from radium emanations contracted in volume, which observation, also noticed by Usher, was confirmed by Lind.

The methods by which "Hyzone" was prepared by Wendt and Landauer all depend upon gaseous ionisation. It has been produced by the bombardment of hydrogen by means of a-rays, by the passage of a high potential electrical discharge in hydrogen under extremely reduced pressures (compare the production of active oxygen, ozone, and of active nitrogen), and by the "Corona" discharge, and in the ordinary ozone producing apparatus. The quantities formed differ, however, and by means of the second method, as much "Hyzone" was produced in one minute as was obtained in eight hours by the use of the first method. In any case, the amount produced is extremely small, representing at best, only about 0·01 per cent. conversion.

"Hyzone" possesses many interesting properties. It is a gas with a higher boiling point than hydrogen, being condensed by means of liquid air, although quantities sufficient for isolation in a liquid condition were never obtained. The activated gas, after cooling in liquid air, showed none of the reactions characteristic of "Hyzone."

It was very rapidly reconverted into ordinary hydrogen by simple standing, and if more than a minute were allowed to elapse between formation and testing no indication of "Hyzone" was revealed. However, by passing the activated gas immediately over sulphur, hydrogen sulphide was produced, at the ordinary temperature. Similarly, on mixing with ordinary nitrogen, ammonia was obtained at room temperatures. Triatomic hydrogen likewise reduced phosphorus, arsenic, acid and neutral permanganate solution.

Wendt and Landauer describe elaborate and varied precautions which were taken to show that the activity of the gas mixture after the formation of the assumed allotrope, was not due to ions pure and simple. The results are perfectly definite, and it is clear that the peculiar properties which are shown must have been due to the presence of some new form of hydrogen. The properties are essentially different from those of Langmuir's atomic hydrogen, and the fact that a contraction in volume had been observed, indicated a "condensed form of the element." The application of the method of positive ray analysis afforded very strong evidence of the existence of triatomic molecules, and its analogy with ozone supports this conception.

The Possibility of the Technical Application of Hyzone

In view of several of the properties of triatomic hydrogen, as described above, it might be doubted if this body could have any application in industry. The high cost of the electrical power necessary to produce even a very small amount of "hyzone"—.01 per cent. of the hydrogen treated—and the extreme rapidity with which it reverts to the diatomic modification, would seem to preclude its economic use. Moreover, the concomitant advantages which seem possible are relatively small. Considering, for example, the production of ammonia, and assuming that by further developments of methods of production, hyzone could be made in greater concentration and more economically, we should still have a high electrical power charge upon the process, which would easily set off the power charges on, say, a Haber synthetic ammonia plant. Again, unless hyzone could be made under high pressures, and immediately brought into contact with nitrogen, the amount of plant required to produce reasonable quantities of ammonia would be excessive. And in the end, the only real advantage would be that catalysts could be dispensed with, in the production of synthetic ammonia.

Bearing in mind the above-mentioned properties of hyzone and its methods of production available at present, it requires little elaboration of argument destructively to criticise the possibility of the technical application of triatomic hydrogen. At the same time there are conceivably many occasions when a reducing agent, presumably active at low temperatures, could be of service in "fine" organic chemistry. The reduction would proceed in a very simple fashion in the absence of any added reagent, and thus provide a "clean" reduction. The prospect is admittedly distinctly vague, but in view of the properties of triatomic hydrogen, it behoves us to be careful in expressing too definitely a destructive argument as to future possibilities. The occasions upon which this has been done, covertly if not openly, in connection with many of the fundamental discoveries which have benefited humanity, must be countless. Let us cast our minds back twenty years and think of Helium. Let us remember Faraday. And examples could be multiplied almost to weariness.

Ozone a hundred years ago was merely an odour. Its applications to-day, if not extensive, are definitely practical. Hyzone to-day is after all a chemical individual, obtained diluted with hydrogen, from which, it is true, it has not been isolated. Its properties entitle it to consideration, and to-day's chemical curiosity becomes to-morrow—who knows?

* It may be noted that Venkatiramaiah has recently described, in a letter to "Nature," an active form of hydrogen. If a mixture of hydrogen and oxygen, containing more of the former than is theoretically necessary for the production of water, is exploded in such apparatus as will enable the remaining gas to come immediately in contact with solutions for reaction, it is noted that the "active" hydrogen will reduce permanganate and ferric solutions, indigo to indigo white, potassium chlorate to chloride, and nitrate to nitrite, &c.

Nickel-Plating of Aluminium

THE problem of the successful plating of aluminium is discussed in a recent issue of *Metal Industry*, and the writer gives some of the experiences of Mr. J. W. Hanlan as described before an American gathering. Mr. Hanlan has tried a number of methods and materials, but he found that most of the cleaners oxidised the aluminium, causing it to peel. He found after experiment that the most effective method was to clean the aluminium in gasoline, then dry in sawdust, after which the articles were wired or racked on iron wires or racks, rinsed for 30 seconds in a solution composed of 6 oz. of soda ash to 1 gallon of water heated to 150°F., rinsed in cold water and then dipped into a solution composed of 2 oz. of perchloride of iron dissolved in 1 gallon of water, where they were allowed to remain for one to two minutes; they were then put directly into the nickel solution. Care was taken to have the current of 2 to 3 volts turned on before putting the work in, and also in having the cathode rod agitating at about 20 revs. to the minute.

In the case of peeled work resulting from carelessness, such as allowing the work to strike the side of the tank or work rod, or allowing the work to remain too long in the air after leaving the iron dip, he has found that a very easy way to strip the nickel off is to put the work in an ordinary bright dip composed of half a gallon of sulphuric and half a gallon of nitric acid with a little salt, as these acids do not affect the aluminium. The nickel is stripped off without injuring the surface of the work.

Electrical Measurement in Chemical Processes

The following article is based on particulars furnished by Messrs. Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, by whom also the blocks are supplied. Further details respecting the developments described may be obtained from the manufacturers.

To no class of manufacturers is measurement of greater importance than to those engaged in the conduct of chemical processes. More, perhaps, than in any other branch of industry does effiicency depend on the continuous maintenance of the proper conditions, and all efficiency has for its basis the accurate determination of quantities, as the necessary preliminary to the elimination of waste. In modern conditions the more important measurements are likely to be electrical in character, and it is fortunate that electrical measurement is one of the most advanced of all sciences.

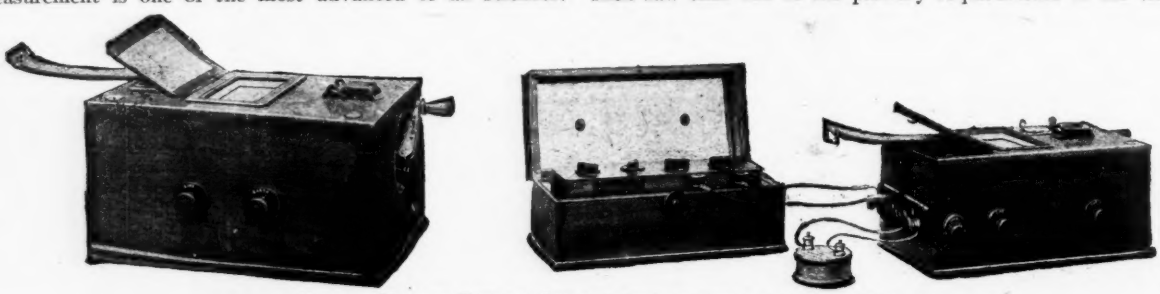


FIG. 1.—MEGGER TESTING SET AND BRIDGE MEGGER TESTING SET

It was, we believe, Lord Kelvin who pointed out that it is easier to measure electrical resistances of average value than it is to measure ordinary lengths, within the same degree of accuracy. Currents and pressures, while not so accurately determinable by instruments suited for use in a workshop, are still easily measurable to higher degrees of accuracy than is usually necessary.

Professors Ayrton and Perry, to whom the science of measurement is so heavily indebted, were the pioneers in the design of instruments suited to industrial requirements, followed at no long interval by Mr. Evershed with his series of ammeters and voltmeters, the progenitors of so many modern types of measuring instruments.

FIG. 2.—" DIONIC " WATER TESTER.

Professor Ayrton joined Mr. Evershed and Mr. Vignoles in 1895 in founding the company, which under the name of Evershed & Vignoles, Ltd., has become so well known and has done so much for the development of measuring instruments. Their aim has been to keep a nice balance between scientific refinements and industrial requirements; and they have, therefore, always laid great stress on making their apparatus robust and simple, so that it might be placed in the hands of unskilled persons, while retaining that high degree of accuracy of which electrical instruments are so eminently susceptible.

Insulation Testing Sets

A good example of this practice is afforded by the well-known " Megger " testing set. As far back as 1889, Mr. Evershed saw that one of the primary requirements of the time was an apparatus for determining the insulation resistance of electrical circuits at or over the pressure at which they were to be used, for it was known that insulation tended to diminish as the volts applied to the circuit grew. Thinking of Professor Ayrton's ohmmeter, which had been designed, but for which no practical use had then been found, he combined an ohmmeter designed for high resistances with a hand generator developing comparatively high pressures. Through many intermediate forms these instruments have developed into the " Megger " of to-day, which is made in various ranges, the highest of which extends to 5,000 megohms.

In a modified form, as a " Bridge-Megger," it performs not only the functions of an insulation testing set, but also those of a Wheatstone Bridge of convenient design; with which, it is claimed, measurements can be made by an unskilled man in 15 seconds, which would take a skilled operator almost as many minutes with a bridge of earlier design. Fig. 1 above shows a " Megger " (left) and " Bridge-Megger " (right), the instruments being open for use.

The ohmmeter embodied in these instruments is made up also in separate form, and is useful for workshop measurements, particularly in cases where a product must have an electrical resistance of definite value. Among the more obvious chemical uses of ohmmeters is the adaptation for measuring resistance of detonator fuses, both of the platinum wire and chemical types. These ohmmeters have found a large field of use in this connexion, since the least skilled operator can be trusted not to pass fuses unless the reading given on the ohmmeter when they are placed in the testing jig is on a certain mark or within certain limits on the scale.

FIG. 3.—PORTABLE AMMETER AND VOLTMETER FOR DIRECT AND ALTERNATING CURRENTS.

Impurities in Water

A further adaptation of the ohmmeter is its application to the detection and determination of the amount of any impurity dissolved in water. The "Dionic" water tester, as it is called, is illustrated in the Fig. 2. It is claimed that by its use any unskilled person can determine in a few seconds the conductivity at 20°C. of any sample of liquid poured into the tube; and from this measurement, if the substance in solution is known, the amount of it can be accurately determined, and in steam condensers cooled by sea water the minutest trace of infiltration is easily detected, while in water softening the point of maximum softness is readily determined. The instrument is undoubtedly of importance to chemical manufacturers, and we hope to devote space in a future number to a more detailed account of the construction and uses of the "Dionic" water tester.

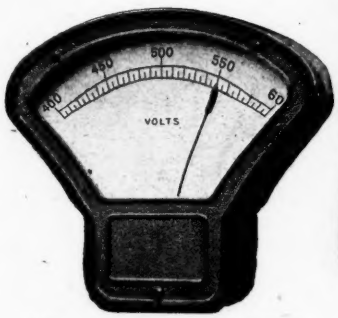


FIG. 4.—SWITCHBOARD MOVING COIL VOLTMETER.

FIG. 5.—SWITCHBOARD RECORDING INSTRUMENT.

Fig. 3 takes us to the more simple developments of instruments for the measurement of current and pressure. It shows a combined ammeter and voltmeter made in portable form, and suited both for direct and alternating current. Apart from transformers, which can be applied to increase its current or volt ranges on alternating current, it forms a self-contained means of measuring on three ranges in each instrument amperes from 1 to 100, and volts from 75 to 600. Fig. 4 shows a voltmeter of the moving coil type, suited for direct current only, and designed to give a continuous reading when mounted on a switchboard panel. It forms a good illustration of the latest developments of switchboard instruments. Used with shunts, the ammeter has practically unlimited range from milli-amperes upwards; while the voltmeter has six ranges of any desired value from millivolts upwards, changed by a switch of convenient form equipped with a safety catch to prevent the use of the instruments on pressures too high for the range employed.

FIG. 6.—PORTABLE THERMO-ELECTRIC PYROMETER.

Fig. 5 shows a recording instrument of unique design, tracing a curve showing the variations with time of the quantity measured, the co-ordinates being rectangular and the curve therefore susceptible of integration. Such curves are of immense value in industry, keeping as they do a continuous and automatic record of the performance of the machine to which they are applied, and their use is therefore growing very fast. They form an infallible check on the time of starting and stopping the machine, and on the power, current or pressure applied to any work. Systematic maintenance and study of records of this character is one of the means most generally employed for checking the conditions of use of machinery with a view to their improvement.

Thermo-Electric Pyrometers

An interesting and important application of current measurement to industrial problems is the pyrometer. Sensitive instruments are used in connection with thermo-electric couples, their scale being divided in temperature. When the temperatures to be measured are comparatively low—say, up to 1,000°C.—the thermo-couple is usually in a sheath, the whole forming a stem actually placed in the hot space or material. For higher temperatures the thermo-couple is generally mounted in a tube directed at the heated body, and the heat rays are focussed on it. Fig. 6 illustrates a typical portable equipment, showing the temperature indicator, and the stem containing the thermo-couple.

Further information on electrical measurement developments may be obtained from the manufacturers, Evershed & Vignoles, Ltd., of Acton Lane Works, Chiswick, London, W.4.

British Chemical Industry

The Key to Future Economic Wealth

THE Association of British Chemical Manufacturers has issued the following statement, signed by representative chemical manufacturers in Great Britain:—

"We extended our research and manufacturing plant at the urgent appeal of the State during the tremendous years that followed 1914, in order to secure those essential products of science without which victory could not be attained. The full record of wartime achievements in the sphere of fine chemicals would read like a romance were the full history disclosed. This key industry is now endangered, and unemployment is rife in it, owing to the flood of imports from abroad which, in other circumstances, the present condition of the exchanges makes devastatingly possible. We desire to submit to public knowledge the following facts:—

"1. The application of chemical science to industry is a necessary factor for the preservation of our world position in commerce. It is also true to say not only that the chemist and the laboratory are in the first line of national defence, but are pivotal in the development of our industrial and commercial resources and wealth.

"2. At very considerable cost, essential plant was erected during the war years, and all of it can now be put to peaceful purposes for the continuance in this country of a fine chemical industry not inferior to Germany's. But, under the present unfair economic circumstances, this plant must become idle and useless, unless the State takes measures for its safeguarding.

"3. The fine chemical industry, mobilised and expanded in the hour of the nation's needs, provided during the war—to give a few examples—(*a*) essential medicinal preparations for naval, military, and civilian hospitals; (*b*) the higher forms of explosives and gases; (*c*) photographic chemicals for aerial use; (*d*) research chemicals, without which the development of many new industrial processes would have been impossible.

"4. British science is no whit inferior to that of competing nations, nor are British chemical manufactures inferior in quality.

"We feel it is our bounden public duty to make known to the country the national importance of an industry which is indeed a key to the unlocking of many doors of economic wealth in the future."

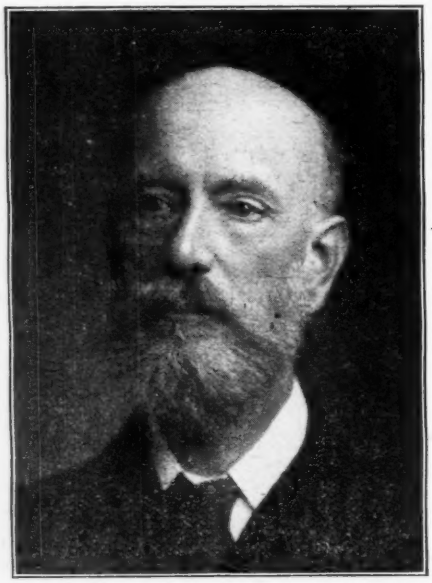
MR. ROSCOE BRUNNER, of Brunner, Mond & Co., Ltd., is a director of the Allied Dye & Chemical Corporation, which was recently registered in the United States.

Death of Dr. L. C. Miall

A Great Scientist and Teacher

WE regret to record the death which took place at Leeds on Monday, at the age of 78, of Dr. Louis Compton Miall, Emeritus Professor of Biology in the University of Leeds, and father of Dr. Stephen Miall, a well-known figure in the Society of Chemical Industry. Professor Miall, who had been ill for some time, died at the house of his daughter, Mrs. Harold Wager.

The son of a Congregational Minister, Dr. Miall was born at Bradford in 1842. He was educated at Silcoates school, but left at 15 in order to take up a teaching post at a small private school in Bradford. He became interested in natural history through contact with the vacation studies of his brother, who was a medical student at Edinburgh, but he had no systematic training. When later, at the age of about 20, he became secretary to the Bradford Philosophical Society, he attended the Leeds School of Medicine in order to learn something of the technique of practical biology. The fact of his being instrumental in bringing to light a newly discovered labyrinthodont from the coal-measures near Bradford



THE LATE PROFESSOR MIALL.

first brought him into relation with Owen and Huxley, and he always attributed much to the influence and friendship of Huxley.

Miall's earlier work (says a writer in *The Times*) lay mainly in geology and palæontology, where he was an eager and fruitful worker. Of his subsequent zoological work, of which the range was wide, the most important part was concerned with the study of insects, and here he took a leading position. His book on the cockroach, published in 1886, in association with Professor A Denny, marked an important epoch in the study of insect structure and development in this country. This book was followed by one on the harlequin fly (*Chironomus*), one on the natural history of insects, and later one on injurious and useful insects.

As a naturalist Miall was imbued with the spirit of Gilbert White, and was an enthusiast for what he termed "live natural history." This spirit was most highly evinced in his two remarkable books, "Round the Year," and "House, Garden and Field," as well as in a scholarly edition of the Natural History of Selborne, which he brought out in collaboration with Dr. Warde Fowler.

Theories of Teaching

While Miall gained an assured and distinguished position as a scientific biologist, he was probably most widely known from the influence which he exerted on the teaching of natural history, especially in its early stages. Himself a lecturer almost unequalled for the lucidity and interest of his exposition he was nevertheless at constant war with lecturing as a means of teaching, and he was ruthless in his condemnation of the mere collector either of things or facts. His book on "Object Lessons fron Nature" has done much to place the study of elementary natural history, or nature study, as it is now usually called, on a sound scientific basis of close observation of nature, and his influence has extended widely over the teaching of biology—and, indeed, of natural science generally—throughout the educational world. His educational philosophy is conveyed in a most attractive form in his "Thirty Years of Teaching."

In 1871 Miall was appointed Curator of the museum of the Leeds Philosophical Society. In 1876 he became the first Professor of Biology in the Yorkshire College of Science, and continued in that office in the University of Leeds till 1907. He then retired to Letchworth, where he wrote a History of Biology and a book on the early naturalists and their work. Here also he had leisure to indulge his life-long interest in the classics, and, following in the path of his gifted wife (formerly Miss Emily Pearce), who had achieved much success in teaching French, he worked out and applied with great zest to a private pupil a scheme for the oral teaching of Latin. His knowledge of the best literature, both ancient and modern, was remarkable. This, combined with a most fastidious taste, which revolted from every kind of sham or extravagance, endowed him with a literary style of singular purity and lucidity, qualities which were embodied also in his spoken word.

On the death of his wife in 1918, Miall returned to the North, and lived at Ben Rhydding, where he continued to find solace in his favourite books. His learning, his high ideals, his single-minded devotion and transparent sincerity, combined with his wise and judicial grasp of educational problems, secured to him a commanding and widespread influence.

Professor Miall leaves one daughter, Winifred, wife of Dr. Harold Wager, F.R.S., the botanist, and two sons, Dr. Stephen Miall, chairman of the Brimsdown Lead Company, Ltd., and Mr. Rowland Miall, director of C. F. Casella & Co., Ltd., scientific instrument makers.

Mr. J. M. Miall.

THE death occurred at Wimbledon, on Tuesday (a day after the death of his brother, announced above), of Mr. James Mackenzie Miall, eldest surviving brother of Professor L. C. Miall, in his 83rd year. Mr. Miall is described as "a man of infinite humour and singular social charm. He had some of the gifts of comedy which distinguished his uncle, Henry Compton, the actor, who was a first-rate linguist, and a skilful musician."

Professor R. B. Clifton

THE death occurred on Tuesday on his 85th year of Professor R. B. Clifton, F.R.S., who had been Professor of Experimental Philosophy in the University of Oxford from 1865 to 1915. On his appointment to this post he erected from his own designs in 1870, and organised the new "Clarendon Laboratory," the first built in Europe for the special purpose of teaching and research in physics. Much of his optical apparatus he designed himself. He served as a member of the Royal Commission on Accidents in Mines, 1879-86, and as president of the Physical Society in 1882-84.

New York Alsace Potash Agency

MR. ARMAND KUHN, director of the Société Commerciales des Potasses d'Alsace, states that his company will open a New York office for the direction of its sales in the United States. Mr. Kuhn, accompanied by Mr. Henri Vigneron, consulting engineer of the company, has been in the United States for some time investigating the situation, and has concluded that the best interests of the Alsatian fields and of the American consumers would be served by establishing a branch of the company in the United States.

NEW COMPANIES registered in the United States of America during January to manufacture and deal in dyes, chemicals and drugs had a total capitalisation of $22,295,000. Three of these companies have an authorised capital exceeding $1,000,000.

Catalysis in Industrial Chemistry

Processes of Catalytic Oxidation

IN his second Cantor lecture at the Royal Society of Arts on Monday on "The Applications of Catalysis to Industrial Chemistry," Dr. E. K. Rideal discussed processes of catalytic oxidation. These, he said, could be divided into three classes, viz.: complete, fractional and selective. Cases of complete combustion were exemplified in the heavy chemical industry where the contact process of sulphuric acid and the oxidation of ammonia to nitric oxide were typical catalytic reactions. Catalysts were employed in these two cases for different reasons; in the first case to effect oxidation at a low temperature on account of the reversibility of the reaction, and in the second case to effect oxidation rapidly to avoid secondary decomposition of the nitric oxide. The catalyst generally employed for both reactions was platinum, but vanadium pentoxide was an equally efficient substitute in the former case. An examination of the platinum gauze employed for the oxidation of ammonia, revealed the fact that it underwent a gradual superficial change during the reaction. With phosphoric free ammonia, crater formation was marked, but with ammonia cyanamide containing phosphene, small metallic crystals were formed, for which no reason had yet been advanced.

Fractional Oxidation

Amongst the cases of fractional oxidation, the drying oil industry was probably the most ancient. The oxidation of the unsaturated fatty acids and their esters was markedly accelerated by the use of siccatines or dryers, such as the oil soluble salts of manganese and cobalt. Ingle had shown that the salts of the polyvalent metals were most active. The reaction was auto and photo-catalytic, and the fading of colours of paintings and cloths was chiefly due to photo-catalytically stimulated oxidation of this type. Recently, the oxidation of the hydrocarbons had attracted a considerable amount of attention, and two processes of fractional oxidation had attained industrial status, viz., the oxidation of naphthalene to phthalic anhydride, and of benzene to maleic anhydride. Specially-prepared vanadium pentoxide was employed as a catalytic agent at a temperature of 350 deg. The production of phthalic anhydride, largely employed for the indigo and phthalin dyes, by this method, was now supplementing the older method of oxidation with fuming sulphuric acid, and where copper and mercury salts were employed as catalytic agents. The oxidation of benzene to the intermediary products phenol, hydroquinone and quinone were possibilities in the method which merited careful investigation, the yields hitherto obtained being either insignificant or small.

The fractional oxidation of the aliphatic hydrocarbons to fatty acids and alcohols with the simultaneous production of waxes, was another example of fractional oxidation worthy of study, owing to the great industrial value of such a procedure. Both fatty acids and waxes, *e.g.*, synthetic beeswax, had already been produced on a small scale by atmospheric oxidation of paraffin wax in the presence of catalytic agents at the low temperature of 130°C. It was, however, in the selective oxidation that the unique properties of catalytic reactions were most evident, for in a mixture of two or more combustible constituents it was possible to effect the combustion of only one constituent by the choice of proper catalytic material. The constituent which possessed the longest life on the catalytic surface, or was more readily adsorbed, was the one which was oxidised in the presence of an oxidising catalyst. It was possible to effect the combustion of methane in hydrogen in the presence of boro-silicates of hydrogen in methane at a palladium surface. Industrially the selective oxidation of carbon monoxide in hydrogen was of great importance as a method for the removal of this catalytic poison. The conversion of methyl alcohol to formaldehyde involved first the dehydrogenation of the alcohol to aldehyde and hydrogen, and secondly the selective oxidation of the hydrogen in the presence of the aldehyde and air.

The development of catalytic processes in the gas industry was likely to proceed during the next decade in many directions. The incandescent gas mantle represented a well known but little understood case of catalytic surface combustion. Various colours could be imparted to the radiation of the gas mantle by the utilisation of other oxides of the same elements. Doubtless a "daylight" mantle would be developed which would be of great value to the gas industry, as far as its function as to the supply of an illuminant was concerned. Catalytic surface combustion had been developed for heating purposes by Schnall in Germany, and Bone in this country. The danger of explosion, and the gradual blocking of fine pored diaphragms, which were necessary for the best utilisation of the catalytic method, however, were grave defects which had not yet been entirely overcome.

Turning to the production of gaseous fuel, Dr. Rideal said that the two simple gaseous constituents, carbon monoxide and the volatile sulphur compounds had been shown to be capable of catalytic reactions. Recent legislation as to the sale of gas on the therm basis, and the fact that a committee had been appointed to investigate the problem of the limitation of the carbon monoxide in gas, might re-direct attention to the methods of raising the B.Th.U., value of blue water gas without carburation with oil or wax. These were based upon reactions, of which the following are typical:

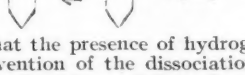
$$CO+3H_2=CH_4+H_2O\,; \quad CO+H_2O=CO_2+H_2\,;$$

each of which was capable of being effectively carried out under industrial conditions in the presence of robust catalytic agents.

Wet Oxidation Developments

Sulphur compounds were burned at the surface of gas mantles into sulphur dioxide, and the gradual oxidation of the sulphur dioxide produced in the room under the influence both of moisture and of sunlight could be demonstrated by determination of the oxygen absorbed from permanganate of samples of the air. Their removal from gases was therefore an important problem. It seemed probable that a catalytic method for the wet oxidation of hydrogen sulphide according to the reaction $2H_2S+O2=2H_2O+2S$ could be developed, oxygen being provided by the admission of air. Colloidal ferric hydroxide exerted a feeble but definite catalytic activity in this respect. In blue water gas the dry catalytic oxidation at the surface of catalytic agents could be effected on a small scale. For the removal of combined sulphur the Carpenter-Evans process of effecting hydrogenation at the surface of reduced metal was in successful operation $CS_2+2H_2=C+2H_2S$. Hydrolysis of carbon disulphide could be effected in the presence of moist aluminium hydroxide and this reaction could probably form the basis of an industrial method, $CS_2+2H_2O=2H_2S+CO_2$.

Owing to the shortage of liquid fuels derived from oil, the increased production of another fuel in the gas industry would be watched with interest. The hydrobenzene produced by the catalytic hydrogenation of benzene at the surface of carefully reduced metal, and ethyl alcohol produced by the catalytic hydrolysis of ethylene, were promising developments. The former had already proved of inestimable value for aeroplane engines on account of its uniformity of composition, but the production of the latter could not yet be said to be on an industrial basis owing to the fact that as long as sulphuric acid was employed as an absorbent and catalytic agent, the cost of the cyclic evaporating and concentration necessary would probably prove to be prohibitive. Hydrogenated naphthalenes had been employed, it was claimed with success, as lubricants. The fractional oxidation of this aromatic hydrocarbon had already been referred to. Renewed attention was being paid to the influence of catalytic agents in the complex cases of hydrogenation and dehydrogenation occurring during the coking of coal and in the distillation of tars. During the coking at low temperature, the complex hydrocarbons apparently undergo decomposition to hydrogenated naphthalene and hydrobenzene. These undergo catalytic reversible dehydrogenation at the surface of hot carbon and the metal walls.



It was evident that the presence of hydrogen in the retort assisted in the prevention of the dissociation of the hydrogenated ring compounds. At 300° C., under a pressure of one atmosphere of hydrogen, dissociation of the hydronaphthalene and hydrobenzene was practically complete. At slightly higher temperatures—350 to 550° C.—the next process in the decomposition of the complex, occurred by means of reactions which were also capable of acceleration by means of hot carbon, but more especially by reduced metals, such as iron and nickel. For these reactions, the ash content of the coal was probably of significance.

Friedel and Cruft's Reactions

The production of diphenyl and hydrogen from benzene, of phenanthrene from dibenzyl and the various other reactions of that type were made possible in the laboratory by the Friedel-Cruft's reactions. At 550 deg. to 650 deg. decomposition of ring structures commenced in the presence of catalytic agents, benzene being decomposed into carbon, hydrogen and hydrocarbon chain residues, whilst at 600 to 700° C. the saturated hydrocarbons undergo thermal degradation, *e.g.*,

$$C_2H_6 \rightarrow C_2H_4+H_2$$
$$CH_4 \rightarrow C+2H_2.$$

The degradation of coal appeared to take place in stages of the kind indicated and in each stage a possible reaction occurred. Equilibrium in the presence of only feebly catalytically-active materials such as dense carbon, and in rapid retort working, might not have time to be accomplished, with the result that the complete products present in coal underwent complete destruction to hydrogen and carbon monoxide with practically the complete loss of the intermediate products which had not only a higher calorific value as illuminants, but possessed potential value outside that of a carburetting agent for gaseous fuel.

Patent Law and Chemical Research

Maximum Protection for Inventions

THE third lecture on Patent Law was delivered by Mr. Harold E. POTTS, M.Sc., on Monday in the Chemistry Theatre of the University, Liverpool, Dr. H. A. Auden presiding. The subject of the lecture was "Obtaining Maximum Protection for an Invention; the Theoretical Problem."

Mr. Potts said that to obtain the maximum protection for an invention it was necessary to prepare a specification which would be accepted by the Patent Office in such a form that when the Court had to interpret it, the claims would cover the widest area possible, consistent with validity. The value of the patent depended on the scope of its claims, since the chief object of patenting was to be able to inhibit infringement and thus secure to the patentee the monopoly of his invention. In chemical cases particularly it was useless to confine efforts merely to drafting a specification which would be accepted by the Patent Office and they must fix their attention on the necessity of satisfying the more stringent requirements of the Court. They should endeavour from the outset to foresee how an infringement might gain some or all of the advantages of the invention, by making modifications in our process, and should then devote attention to closing up these avenues of escape from the patent so as to secure the most complete monopoly possible.

Stages of Completeness

An invention may be regarded as complete in several senses: (*a*) It may be complete in the laboratory. For instance, a full study may have been made of the conditions necessary to obtain a synthetic perfume by oxidising an aromatic alcohol to an aldehyde with a certain oxidising agent. (*b*) Another stage is that of technological completeness, when the chemical engineering and other problems of large scale operations have been solved. (*c*) It was not legally complete until possible variations had been explored to provide sufficient materials on which to base a strong patent. Commercially the invention was not complete until it had passed all three of these stages, because until it was legally complete, the monopoly of the results of the technological work was not secure. It was not usual for the infringer to make a bare-faced copy of the invention, and he generally modified it. If it had been discovered that a certain organic body could be sulphonated if an inert solvent was used as the reaction-medium; that an excellent solvent had been found in the laboratory, and that the plant was working satisfactorily, three types of infringement were possible:—(1) The same idea may be taken, *e.g.*, use of an inert solvent, but a real improvement or development may be made, *e.g.*, it may be found that some new solvent is much better than those mentioned by the inventor. (2) A really alternative idea may be worked out. It may be found that while still using the principle of a solvent as diluent, the results can be obtained by using one of the reaction products as the diluent. (3) An evasion may be attempted. If the patent is important it may be worth while even to sacrifice some of the advantages of the invention, if by so doing, the infringer can work outside the claim of the patent. Thus, instead of using an inert solvent, he might find that some of the chief advantages of the invention were still obtained by using a reactive solvent. An infringement may therefore be an improvement, an alternative, or an evasion.

Improvements and Infringements

An improvement may well be an infringement and yet a patentable novelty. It is vital that this distinction should be grasped. In the early days of the dye industry, the Badische Company held a patent for coupling sulphonated naphthols with diazo compounds. It was found that the sulphonation could be performed by the use of oleum instead of sulphuric acid. This might have been clearly a patentable improvement, yet it was also an infringement of the patented process. In such a case the first patentee cannot use the patented improvement, nor can the second patentee infringe the earlier patent, so that a deadlock will result until one of the patents expires, or until a licence is given by one of the patentees.

Alternatives are often used, especially when independent inventors have been working on the same problem, along somewhat different lines, and one inventor had patented his solution. If he realises the breadth of his invention, he can often obtain a patent which will cover the other solution. In any case, he must remember that, apart from independent invention, rival firms will endeavour to find a solution which will not be tributary to the patent.

Doctrine of Equivalents

Some help was to be obtained here from what was termed the Doctrine of Equivalents. It was a principle of law that the claim of a patent, not only covered the exact class of process defined in words, but also any process which would be obviously regarded by skilled chemists as equivalent at the date of the patent. Thus, in an alumino-thermic process, a mixture of aluminium and silicon was held to be chemically equivalent to aluminium itself. But the scope of the Doctrine of Equivalents was singularly limited in chemical cases, and the House of Lords has held that soluble nitro-cellulose in an explosive was not the chemical equivalent of insoluble nitro-cellulose, and in another very old and classical case, that a mixture of manganese oxide and carbon was not the chemical equivalent of manganese carbide added to molten iron in steel making. It was not, therefore, wise to place too much reliance on this doctrine, and the greatest attention should be devoted to foreseeing possible equivalents and verifying the possibility of their use.

The improvement and the alternatives were, at any rate, of potential technical importance. An infringer might attempt an evasion in which a worse process was used in the hope that it would be regarded as outside the patent. It would be good business to sacrifice 5 per cent. in yield, if this avoided payment of a 10 per cent. royalty.

Preventable Evasions

These evasions could be often prevented if the inventor were willing to take some trouble to ascertain the second-best variations of his invention. An evasion was often a modification in a backward direction, nearer the old practice, in the hope that it will be sufficiently good to be valuable and yet not quite good enough to be an infringement.

The function of a provisional specification is to describe the nature of the invention. The task is to generalise the original idea by a process of induction and deduction, and the whole legal and technical equipment of inventor and patent agent should be concentrated on the problem. The following materials will be required in the ideal case:—(1) The existing states of public knowledge, especially as shown by patents and literature, but also as modified by the knowledge of processes actually used by others in England. All this is termed "the state of the art," using the word "art" as synonymous with the branch of technology in question. (2) The experimental results obtained by the inventor, including the best results and the negative ones also. (3) The theory which is considered to underlie the invention, *e.g.*, the mechanism of the reaction, not necessarily for inclusion in the specification, but for use in the mental analysis of the invention. (4) A forecast or programme of future work. These materials, the state of the art, the experimental results, the theory and the programme of development were the ingredients

which must be thrown into the legal crucible and fused into a provisional specification.

Assuming that we are in possession of these raw materials and that it is desired to draft a provisional specification, the next steps are:—(5) To generalise. (6) To test the generalisation by considering.

The provisional specification was the foundation stone, and it should be securely laid. The provisional was of enormous importance in establishing priority in foreign countries. It might well happen that the inventor had discovered that a certain nitration was successful if dilute nitric acid were used. The exact strength and temperature of operation should be specified by way of example, and the protection need not be restricted to this example.

Anticipating Infringements

The lecturer next dealt with the problem of generalisation and forseeing infringements. This, he said, represented a logical process of mind in which the available materials were first analysed, so that a guiding principle might then be synthesised. There were certain artifices which might be employed and certain types of development which recurred. For instance, a reagent must be considered, not as a substance, but as a member of a class. The difficulty often was to ascertain which was the class. Thus, if phenol be used, could we expect hydroxylic bodies in general to be useful, or would we find that even dihydric phenols were excluded, and so on. The first point, therefore, was to compare every reagent with its equivalents, especially its homologues, or compounds containing elements from the same group of the periodic system. But we must be on our guard for exceptions, *e.g.*, even caustic soda and caustic potash were not always equivalent in organic fusions. The experimental data should be considered on physico-chemical lines, and, in particular, the possibilities of mass action should be studied. It would be seen that the preparation of a provisional specification, if well done, opened out issues much wider than purely legal ones. That which had been described was essentially scientific procedure, and it followed the broad lines laid down by scientific methods.

At the conclusion of the lecture Mr. Potts replied to questions raised by Dr. F. W. Kay, Dr. A. Turnbull, Mr. C. W. Souter and the Chairman.

Society of Dyers and Colorists

Manchester Section

Two Papers of considerable interest to Dyers and Colourists generally were read on Friday, the 18th instant, to the members of the above-mentioned Section; the first being entitled "Notes on Fur Dyeing," by W. F. A. Ermen, M.A., and the second, "On the Estimation of Indigotin," by William Thomson, F.R.S., F.I.C. There was a large attendance of members and a keen discussion followed the reading of both papers.

Notes on Fur Dyeing

In commencing the reading of his paper, Mr. Ermen stated that the first historical mention of any process analogous to the dyeing of furs was with respect to the dyeing of human hair *in situ*. The first patent for the dyeing of human hair was taken out by Erdmann, in 1888. Phenylene diamine was employed for the purpose, and, in itself, was practically a colourless substance in solution, but it rapidly oxidised through a whole series of compounds, finally becoming a dark brown, almost black, insoluble substance which firmly fixed to the hair, or, as a subsequent patent showed, to fur. From that time onwards a whole series of substances were tried, one after the other; methylated phenylene diamines, amino-phenols and their derivatives, and various diamines. In some cases the hydroxy group was substituted by the methoxy or ethoxy group; but even to-day the bulk of furs were dyed with p. phenylene diamine. Mr. Ermen then exhibited a large number of examples of dyed shades which had been obtained with scoured white furs.

Mordanting with Metallic Salts

If the fur was first mordanted with metallic salts a range of varying degrees of shades could be obtained. The mordanting was always done by allowing the fur to lie overnight in a solution containing about 0·5 per cent. of sodium bichromate, ferrous sulphate, or copper sulphate, or a mixture of any two, with also about 0·5 per cent. of acetic acid. The furs were washed with weak soda or weak ammonia, rinsed, and allowed to lie in the mordant. The next morning they were taken out and washed, and if it was not desirable to proceed with the dyeing forthwith the material could be dried and stored.

In the case of phenylene diamine, the initial stages of oxidation had been worked out by Bandrowski. The first body which had been isolated was apparently formed by the condensation of three molecules of phenylene diamine. The product of the first oxidation was a brown body, but the final oxidation appeared to be black in almost all cases. Perhaps the most important fur dyes were the amido-phenols, and Mr. Ermen illustrated this point by showing a number of examples treanted with ordiary p. amido-phenol and also explained the effect of the following mordants: chromium, chromium and copper, iron, and iron and copper.

The application of amido-cresol and diamido-phenol was also dealt with, the latter being the amidol of the photographer, and giving a curious range of unmordanted red or red-brown shades of which examples were also shown. In regard to mordants, chromium and copper was very poor, chromium alone was much deeper, iron was good, and iron and copper fairly good. Ordinary amidol was di-amido-hydroxy-phenol, usually occurring in commerce as the hydrochloride. Ethylated amidol, instead of browns, produced almost pure slatey greys, which by daylight were rather rusty looking, but had the property of combining very well with p. phenylene diamine and giving an intense blue black.

A further range of shades could be obtained by the use of more amido groups and hydroxy groups, with the addition of chlorine, but these compounds were more difficult to attain with purity. In some cases the oxidation of the body was very rapid and in others very slow, there being hardly any change overnight.

The shades were all obtained in the same way: 1 to 4 grammes of the dyestuff in a litre of water, giving the mordanted or unmordanted fur a few turns in the liquor, adding sufficient ammonia to make it alkaline, and then hydrogen peroxide up to a quantity of 20 cc. to 40 cc., or even more, per litre. The amount of ammonia and the amount of hydrogen peroxide had a certain influence on shade, and it was necessary to bear this in mind in case of matching a given material. For a preliminary attempt, it was sufficient to make the liquor alkaline and add about 50 cc. of the hydrogen peroxide per litre, leaving overnight, the colour being fully developed by next morning.

The following members took part in the subsequent discussion: The Chairman (Prof. Knecht) and Messrs. Bloch, Radcliffe, Hannay and Vlies.

The Estimation of Indigotin

After epitomising the work which had been done during the last 50 years, Mr. Thomson described the process which he found to be the most simple and accurate for determining the percentage of indigotin, especially as applied to synthetic indigo 20 per cent. paste.

He found that sulphonation could be easily effected with the ordinary strong pure sulphuric acid at 50°C. using 30 cc. of that acid to 1 gramme of the paste. This process was carried out after drying the paste, but he had found that it could be applied directly to the gramme of paste without previous drying, and the results were lower only by a very small fraction of 1 per cent.

The process was carried out at first by digesting 1 gramme of the material at 50°C. for 3 hours, but it was finally found that in half an hour the sulphonation was complete. After sulphonation the sulphuric acid mixture was poured into ¾ of a litre of water, and finally, with washings, made up to 1 litre and thoroughly mixed. 200 cc. were withdrawn, mixed with 800 cc. of water in a white basin, and titrated with N/50 potassium permanganate solution which was run in till the blue colour disappeared. This could be determined to within one or two drops. The end reaction was determined by the colour of the liquid against the side of the basin.

Messrs. Knecht, Hannay, Bloch, Knowles and Miss Eva Hibbert took part in the discussion.

The British Industries Fair

Some Interesting Exhibits at the London and Birmingham Sections

On Monday the London and Birmingham sections of the British Industries Fair opened simultaneously, and from all appearances the number of foreign visitors is likely to exceed that of last year. Since its inception in 1915 the record of the Fair has been one of continuous growth in scope, utility and reputation, and although started as a temporary expedient it made so instant an appeal that it is now established in a predominant position amongst the great trade fairs of the world.

In Building H at the White City are to be seen scientific and optical instruments, drugs, perfumery, soaps, photographic chemicals, scientific porcelain, laboratory glassware.

Chemicals and Drugs

Frederick Allen & Sons (Poplar), Ltd., are showing a selection of chemicals of their own manufacture, lead chromes, and the well-known "Ivy" glues. W. J. Bush & Co., Ltd., have a pleasingly arranged exhibit, in which are shown such synthetic drugs as spasmodin, salicylic acid and salicylates, chloroform, aspirin and thymol, while amongst the synthetic perfumes are vanillin, artificial violet, terpineol, and methyl acetophenone. Prominence is also given to perfumery, culinary essences and essential oils.

The General Chemical & Pharmaceutical Co., Ltd., show chemicals for photographic, laboratory and industrial use in addition to a variety of pharmaceutical chemicals. The exhibit of Johnson & Sons, Manufacturing Chemists, Ltd., shows the progress that has been made in the manufacture of photographic developing agents. A very wide range of the "Scales" brand chemicals, which is displayed on the stand, includes photographic chemicals, dyes and chemicals for cinematography, salts of precious metals and process chemicals, while Thomas Tyrer & Co., Ltd., draw attention to their bismuth scale preparations, copper, cadmium, potassium and nickel salts, collodions, stearates, anti-foulers, oleates and other products.

Brown & Son, of Alembic Works, Holloway, show a new patented self-sealing cover for autoclaves. This cover obviates the use of a large number of bolts and nuts, a perfectly sound joint being made by screwing down one central nut sufficiently tight to hold the face of the cover up against the underside of an inwardly projecting rim. The rising pressure inside automatically pushes the lid upward, and a sound joint is maintained even if the central nut is loosened. To facilitate the opening of the autoclave after use a cross bar is arranged to hinge, and may be swung aside. Oven stills, vacuum pans, and other laboratory apparatus are also exhibited.

Chemical balances, standard weights and measures, hydrometers, saccharometers and petroleometers are shown by L. Oertling, Ltd., while Townson & Mercer, Ltd., show chemical and physical balances, oil testing, flashpoint and viscosity apparatus.

Scientific Glassware

Glassware, scientific and optical, is well represented, including exhibits by the Anglo-French Manufacturing Co., manufacturers of medical and chemical glassware; Robert B. Clarke & Co., of Manchester, the sole makers of the "Clarke" push-valve stopcock for the rapid delivery of fluids; Duroglass, Ltd. (Webb's Crystal Glass Co., Ltd.), manufacturers of special glass apparatus for laboratory work, all kinds of lamp-blown scientific glassware and gas analysis apparatus; Hyposol, Ltd., a branch of James Powell & Sons (Whitefriars), Ltd., manufacturers of ampoules, in various colours and sizes, and of fine lamp-blown work for all purposes; R. Johnston & Co., Ltd., manufacturers of scientific glassware; Joseph Long, manufacturers of gauging rods and rules, hydrometers and laboratory glassware; John, Moncrieff, Ltd., of Perth, manufacturers of scientific and chemical glassware, acid plant and explosives outfits in glass; Plowden & Thompson, Ltd., of Stourbridge, manufacturers of soda and lead-glass tubing and small lamp-blown ware; Scientific Supplies Co., Ltd., manufacturers of Soxhlets apparatus, centrifuge tubes and laboratory apparatus in metal, wood, and glass; and Wood Brothers Glass Co., Ltd., of Barnsley, manufacturers of the "W." brand of chemical glassware made chiefly in highly resistant glass.

The British Glass Wool Co., Ltd., show glass wool for chemical use and Messrs. Dring & Fage show their chemical thermometers for laboratory stills, Metrolac instruments for testing rubber latex and laboratory apparatus generally.

Benn Brothers stand, No. 8 in Section "G.," contains a complete set of the journals and technical books published by the firm. In addition to THE CHEMICAL AGE, *The Cabinet Maker, The Electrician, Farm and Home, The Fruit-Grower, Gardening Illustrated, The Gas World, The Hardware Trade Journal* and *Aeronautics*, are represented.

Representatives will be in constant attendance, ready to deal with all inquiries concerning the firm's publications, and advise and help visitors on trade matters covered by the Benn Brothers organisation.

Birmingham Section

The Birmingham Section, which opened on Monday at Castle Bromwich Aerodrome, is being well attended. The exhibits of paints, varnishes and enamels are of a most comprehensive character, and some of the stands are of exquisite design and most artistically decorated. In this respect they occupy pride of place in the Fair. Naylor Brothers (London), Ltd., of Slough, Bucks, are represented by a stand on which samples of the decorative effects of high-class varnishes, enamels, stains and prepared paints are prominent.

The South Staffordshire Mond Gas (Power & Heating Company), of Tipton, have a display which is a good example of the effective use which is made of residual products from the manufacture of producer gas. The tar is put through stills and from the distillation the oil and pitch is utilised, the latter to the manufacture of a bituminous plaint for the preservation of iron, steal and wood structures; it has the appearance of enamel. The oil is the basis of a variety of preparations: (1) a scientifically compounded wood preservative; (2) a non-poisonous sheep dip, which has the approval of the Minister of Agriculture; (3) a liquid disinfectant; (4) a weed killer; and (5) another grade of disinfectant for the treatment of the hands of operatives in machine shops who have to deal with cutting lubricants which sometimes cause skin rash.

One of the most arresting stands in the Fair is that of Messrs. Gittings, Hills & Boothby, Ltd., of Birmingham. It is represented by a tower surrounded by battlements and surmounted by a smaller tower at each of the four corners; paints and varnishes are featured, and an apparatus consisting of an overhead gravity tank, to contain from 10 to 40 gallons of material, is shown.

There is a good deal of variety in the exhibit of Thomas Howes, Ltd., of Smethwick, which includes metal cutting and preserving compounds, including steel-work paints, rust and heat resisting paints, non-poisonous enamels and spraying, stoving and air-drying enamels, oils and metal-cutting lubricants, and rust preventers.

Nobel Industries, Ltd., show varnishes, lacquers and enamels in great variety. The fine effects of the "Necol" varnishes and celluloid varnishes are apparent, and an added interest is given by nitro-cellulose solutions for industrial purposes, and gold bronze and aluminium powders.

For the metal and allied trades lacquers, varnishes and enamels are shown by the Crane Chemical Co., Bordesley Green, Birmingham; they include frosting lacquers for incandescent electric lamps, the object being to minimise the excessive glare; spray lacquers; brilliant black cycle enamels, and a gold dye process which gives a good imitation of gilding on brass and electro-brassed articles.

A good illustration of the excellent finishes to be obtained from stoving and air-drying varnishes, enamels, &c., is afforded by Messrs. Arthur Holden & Sons, Birmingham.

The stand of the Hockley Chemical Co., Ltd., Birmingham, includes electro-plating salts for metals, chemicals for a variety of trades, potash tanks, &c. Another well-arranged stand is that of W. Canning & Co., Birmingham, who show a host of materials for general electro-plating, polishing, bronzing,

lacquering and enamelling, as well as vats and a variety of chemicals of general use in industrial laboratories.

Paint Sprayers

Demonstrations with paint spraying plant, on big scale lines, are given by the Airostyle & Lithos, Ltd., of London. The system is particularly easy of application in works having compressed air; for then works painting and lime washing or distempering may be undertaken at any time. Chemical lake colours are exhibited by Messrs. Oliver Wilkins & Co., Derby, who specialise in lead and zinc chromes and greens, permanent reds and maroons, &c., for paint, linoleum and printing ink trades. They also manufacture beta-naphthol and its derivatives for the production of aniline dyes. Tin and zinc salts and cleaning compounds and chemicals may be seen on the stand of Messrs. G. Jones & Co., Birmingham.

Enamelling stoves are exhibited by Messrs. W. Goodyear & Sons, Ltd., Dudley; paint kettles by the Crown Hollowware Co., Cradley Heath. The important part which oils and lubricating oils play in modern industry and in motor transport is shown in some large and comprehensive displays. These include Messrs. Fitchetts, Ltd., Birmingham; Nightingale & Co., West Bromwich (who display industrial oils and greases, as well as linseed oil, &c., and linseed oil substitute); the Anglo-American Oil Co., Ltd., and the North British Manufacturing Co., Glasgow, in oil enamels, &c.; and Messrs. T. Howse. The Graphite Products, Ltd., have an interesting exhibit of graphites for packings and lubricating, and among other features a silica graphite paint for the protection of iron and steel work.

Glasgow Section

The Glasgow Section of the Fair, which will be opened on Monday next in the Kelvin Hall, will consist mainly of exhibits associated with the textile industries, dyes and chemicals.

The Glasgow Fair will close on March 11, while the London and Birmingham Sections will close simultaneously on March4.

The Chemical Engineering Group

Proposed Glasgow Conference

A MEETING of those interested in the development of chemical engineering was held at the Institution of Engineers and Shipbuilders, Glasgow, recently, when an address was given by the Chairman of the group, Mr. J. Arthur Reavell, on the industrial importance of chemical engineering. Mr. J. H. Young, Chairman of the Glasgow Section of the Society of Chemical Industry, was in the chair.

The chairman said the object of the meeting was primarily to hear Mr. Reavell's address and also to listen to an account of the work that was being done by the Chemical Engineering group in the education of technical opinion regarding chemical engineering. He outlined the history of the Chemical Engineering group and pointed out how acute had become the need for such a body charged with the educational development of chemical engineering during the past few years, and pointed out that the Society of Chemical Industry, although orginally, intended for the consideration of chemical engineering matters had largely, owing to its wide interests, left such matters to a large extent in the background.

Mr. Reavell in the course of his address said that however much we might dislike the thought, we had to admit that up to 1914 the German nation had obtained a position in chemical engineering which was unequalled by any other nation in the world. Although the Germans had established that reputation, however, they did not deserve it. Large numbers of ideas and processes which were established in this country by people who were too modest, or were without sufficient confidence in their own abilities, were re-born in Germany and brought over here and received by buyers in this country in the most astonishing way. A case in point was that of a certain company which owned patents in this country which it worked and developed. A large and chemical manufacturing firm, which had refused even to consider a proposal for the use of a patent from the inventor, subsequently bought a complete plant from the first-named company's German licensee at a higher price than he would have had to pay for the British plant. This worship of the German cult was one of the great stumbling blocks to the development of chemical engineering in this country. The war, however, had given our chemical engineers an unique opportunity to prove their worth, and he claimed that the British chemical engineer to-day was in a better position technically than the German chemical engineer was in 1914.

Training of Chemical Engineers

He believed that if the chemical manufacturer would give the British chemical engineer an opportunity to solve his problems he would be able to do so, providing the manufacturer would agree to go into the matter in a sympathetic manner in order that they could be discussed in all their bearings, including the chemical, the mechanical and the commercial side. It was easy enough to construct machines during the war when cost was of no account and the only question was that of getting delivery. Now, however, when things must be looked at from the commercial point of view, it was essential that the chemical manufacturer, the chemist and the chemical engineer must combine and use all their knowledge to obtain the desired results. We had now to consider the economical running of our chemical works if we were going to be able to meet the continental competition. This brought up the question of the training of chemical engineers. At present we had no satisfactory course in chemical engineering in our universities, but he was glad to say that Professor Hinchley would shortly have a splendid course in full swing at the Imperial College of Science and Technology. Prof. Donnan, of University College, London, was also working in the same direction. It must be admitted that the German universities had completely beaten us in this respect up to now.

There was found on the Continent a greater willingness on the part of the chemical manufacturer to put the whole of his problems in the hands of the chemical engineer than there was in this country. It was a long time before he could make up his mind as to the reason for this reticence, but he had now come to the conclusion that it was very likely the result of the old system of so-called sceret processes that had been the bane in the past of the chemical industry. The secret process must be a thing of the past, except in exceptional cases. To be successful the chemical industry must be developed on a practical scientific basis. It was a recognised fact that many of our chemical works were working under obsolete conditions, compared with Continental practice, and this demonstrated the vital importance of chemical engineering. Unless we wished to see our chemical manufacturers going to Germany or America again for their ideas and plant, we must encourage and develop this side of engineering to the fullest extent. The conditions of the past, however, were by no means due solely to the chemical engineer in this country, but were often brought about by the lack of encouragement and understanding on the part of the chemical manufacturer. At the same time it must be realised that before the war the chemical manufacturer was fighting against odds and could not risk the sinking of more capital in newer plant because of the unfair foreign competition he had to meet, competition which was subsidised by the foreign Governments.

The Human Element

Referring to the process man in chemical works, Mr. Reavell said that no one admired him more than he did himself; he knew by a wonderful intuition when certain processes were finished or when a liquor was at a certain density or when some physical fact in regard to their processes took place. These men, however, were a great stumbling block in the way of progress. They felt that when new schemes were discussed or when new plant had to replace old methods, that they had not the strong hold they had before, and much trouble had been caused from this source both to the manufacturer and the chemical engineer. This meant that such human elements must, in the interests of progress, be reduced to a minimum and scientific apparatus of the simplest kind must be substituted.

Another aspect of the importance of the chemical engineer was his position in relation to the industrial advancement of the British Empire. There was no doubt that in the future more than in the past the whole industrial sources of the Empire would have to be exploited and used, but they could only be used if it was possible to work them as a commercial proposition. The reason why, before the war, so many of our own natural products were exploited almost entirely for the benefit of Germany was because German chemists and commercial men worked hand-in-hand with the German financiers.

There were, therefore, two points he wished to emphasise, viz., that the industrial importance of the chemical engineer was recognised in Germany sooner than in this country; and, secondly, that he was supported by their financiers. How we were going to get this same combination in this country he could not, at the present moment, see.

In conclusion, Mr. Reavell described the work which the Chemical Engineering Group has already done and suggested that a Conference should be held in Glasgow on the lines of those already held in other towns.

Training Facilities

Mr. H. TALBOT (Hon. Sec. of the Chemical Engineering Group) expressed his pleasure at being privileged to address the meeting and paid tribute to the excellent work undertaken by the honorary local representative of the Group, Mr. J. MacGregor, which had resulted in such a splendid gathering. He emphasised the need for some such body as the Group in the light of recent national experience, and reminded the meeting of the utterances of prominent men regarding the necessity for chemical engineering development in this country. He said that over 60 per cent. of the institutions of university rank in the United States had courses in chemical engineering, the first of which had been inaugurated as far back as 1892. This country, on the other hand, was extremely backward in organising such facilities, although a number of local Education Committees—for example, those in Leeds, Bradford, Huddersfield, Manchester and Birmingham—had arranged for a series of lectures on chemical engineering subjects..

A discussion followed in which the hope was expressed that a Conference would be held in Glasgow, as suggested by Mr. Reavell.

Waste Water Purification Plant

Typical Processes Described

A MEETING was held on Thursday in the Technical College, Huddersfield, under the auspices of the Chemical Engineering Group of the Society of Chemical Industry, when Mr. E. V. Chambers read an interesting paper on "Plant for the Purification of Industrial Waste Waters." Mr. J. Arthur Reavell, M.I.M.E., Chairman of the Group, presided.

The term "waste water," said the lecturer, was purely relative, and many effluents formerly classed as waste had now become sources of national wealth and individual profit. This result had been brought about by the stress of competition, and also by the Rivers Pollution Act. Ultimately, even the purified effluent, unless re-used in the manufacturing process, would be regarded as "waste" in the real sense.

There was a general similarity between all effluents resulting from the same trade processes, but as limitation of time prevented exhaustive treatment typical cases were cited from the woollen industry and from metal working industries using "pickle" liquor.

The woollen industry yielded three distinct classes of effluent for treatment, viz.: (*a*) Raw wool washing effluent; (*b*) yarn and piece scouring effluent; (*c*) dyeing process effluent; each having its own special properties and mode of attack. In all cases a necessary preliminary was the separation of fibre carried away by the effluent, and a mechanical screening process was universally employed. The original fixed 1-16 in. to ¼ in. wire mesh screens were unsatisfactory, partly from incomplete retention of the fibre, except when completely blocked by an accumulation, when the screening action of course ceased. Modern practice was to use a circular screen rotating in an effluent pit at about six times the rate of flow of the liquor, and so arranged that the fibre was automatically squeezed and discharged from the surface as the operation proceeded.

After the screening of effluent, the subsequent treatment was partly mechanical and partly chemical, and depended in each case on the particular liquor being handled. Suspended solids were removed by settling tanks, gravity filters or centrifugal filters of the "Gee" type, and colloidal materials were extracted in a similar manner after the addition of a suitable precipitant, *e.g.*, aluminoferric, sulphuric acid, ferrous sulphate or other material. A typical scheme of treatment was illustrated by the process adopted for purifying the effluent from a woollen piece scouring factory which was first described generally, and later with particular reference to an actual installation.

The pieces before scouring contained up to 10 per cent. of oil of varying composition, ranging from 60 per cent. fatty acids upwards. The object of the scouring process was to remove this by saponification of the grease with alkali, producing a liquor to be treated for recovery of soap, soda and oil, after removal of the fibre by screening.

The effluent divided itself into two kinds, which were treated separately. The first portion corresponded to the actual scouring process, and contained the greater quantity of the soda ash and soap and oil, whilst the second portion resulted from the washing of the piece with water, and was much weaker in the aforementioned constituents. The quantities handled were roughly 10,000 gallons of effluent per ton of cloth scoured, containing roughly 4 cwts. of oil and 2 cwts. of soda ash; and the treatment consisted in the addition of sulphuric acid to the scouring liquor to neutralise the carbonate and set free the oil, which rose to the surface. After standing, the clear acid water was withdrawn and the oil separated from the magma by passage through steam-heated filter presses. A typical plant with a capacity of 22,000 gallons per day of strong scouring liquor was described and illustrated.

The chemical treatment of the strong liquor with sulphuric acid was simple, and the plant for effecting this included as a desirable feature some stirring device such as compressed air or steam jet blowers. Settlement for 12 hours usually followed the stirring and addition of the acid. The clear acid water was removed for further treatment and the grease separated from the magma remaining in the tank by forcing the whole by compressed air through steam-heated filter presses, the cakes being steamed until grease ceased to appear at the filter outets. The oil, mixed with water, was run to an acid treatment tank, thoroughly agitated with about 1 per cent. sulphuric acid and allowed to settle. After clarification it was available for re-use and circulated practically indefinitely. The press cake found application as a fertiliser after being treated by a solvent extraction process for the recovery of further quantities of oil resulting ultimately in the return to the process of about 90 per cent. of the original lubricant.

The second portion, or weak scouring liquor, was treated either for re-use or purified before rejection to the drains or river. The method of treatment for effecting either purpose was described, and was in general similar to the one used for the "strong" liquor, with the addition of some precipitants of the nature of aluminium sulphate along with sulphuric acid. Photographs and diagrams of actual plant were shown, and details of the treatment and samples taken from the process were available. The treatment of general effluent for production of a non-polluting discharge into a stream was next described, and illustrated by the description of a plant built up of units with a capacity of 2,000 gallons each of waste water per hour.

The treatment of effluent, said Mr. Chambers, is at times a source of very considerable profit, and need at no time be other than an asset to the manufacturing process. He then described one of the most successful of the older recovery processes—the Smith-Leach process—and dealt with the modern centrifugal method which produces wool fat of twice the value at half the cost of the "acid" or chemical processes. In addition, the centrifugal process permitted of recovery of the potash, which in the acid scheme was lost.

The treatment of another class of effluent, viz., pickling liquor from various metal working factories was next described. The waste pickling liquor contained about 0·5 per cent. by weight of free hydrochloric acid, and about 20 per cent. of ferrous chloride. The method of treatment was briefly to add enough sulphuric acid to set free all the combined chlorine as hydrochloric acid, and obtain this by distillation. The iron was recovered as ferrous sulphate.

The operation of a typical plant was described, and slides, photographs, diagrams and data of its operation were given.

PROF. J. W. HINCHLEY delivered the second of his series of lectures in chemical engineering at the Bradford Technical College, on February 16. The lecturer dealt with the heating of stills, the effect of surface resistance and of scale on the co-efficient of heat transmission, and with the design of steam heating coils, steam jackets, tubular vessels and simple condensers.

Muriate or Sulphate of Potash

Comparison of Fertilising Properties

THE practice of using muriate of potash in preference to the more costly sulphate of potash is now gaining ground in some of the principal potato growing districts, and it should be of interest to potato growers in general to know that this preference for muriate of potash is theoretically and practically sound.

The results of extensive trials made by the department of Agriculture in Ireland over a period of six years, as shown hereunder, show that muriate of potash not only gives a heavier yield than sulphate of potash, but also a much higher proportion of saleable potatoes. The average results of 228 trials during the six seasons 1906-1911, with equal amounts of potash, are given below :—

Manuring.	Muriate of potash with sul. ammonia & sup. phosphate.	Sul. of potash with sul. ammonia & sup. phosphate.
Total yield per acre ...	10 ton 17 cwt.	10 ton 12 cwt.
Value of crop after deducting cost of manure ...	£15 5 7	£14 9 11

The average returns from the sulphate plots were much reduced owing to the fact that they yielded a greater proportion of small potatoes, 1 ton 17 cwt., as against 1 ton 12 cwt., from the muriate of potash plots.

The following was the average in a similar series of experiments carried out in each county in Ireland with equal amounts of potash :—

Manuring.	Mur. of potash, sul. ammonia, sup. phosphate, dung.	Sul. of potash, sul. ammonia, sup. phosphate, dung.
Average total yield ...	10 ton 15 cwt.	10 ton 8 cwt.
Average profit from use of manures	£8 4 4	£7 8 7

The Irish Department's trials are practically the most complete that have yet been made in comparing muriate of potash with sulphate of potash.

The technical examination of the matter also points to the fact that sulphate of potash has the disadvantage of reducing the proportion of lime in the soil to a greater extent than muriate of potash. The reactions which take place with the calcium carbonate in the soil result in the formation of calcium sulphate from sulphate of potash and calcium chloride from muriate of potash, but while one proportion of lime is sufficient to combine with two proportions of the chloride radicle, it is only sufficient for one of the sulphate, as may be seen by comparing the formulæ $CaCl_2$ and $CaSO_4$. Actually double the amount of lime, therefore, is taken up by the formation of calcium sulphate, and since this compound is readily washed out of the soil, as shown by analysis of the drainage water at Rothamsted Experiment Station, it may be safely stated that the loss of lime from the use of muriate of potash is not so considerable as in the case of sulphate of potash.

The following table shows the amount of lime in the drainage water from the Broadbalk Wheat Field according to the five analyses made by Dr. Voelcker after certain manurial dressings had been applied :—

Manurial dressing.	Sul. am.	Sul am., sup. phos.	Sul. am., sup. phos., sul. pot.	Sul. am., sup. phos. sul. mag.
Proportion of lime in the water in parts per million	154·1	165·6	201·3	226·7

The figures show that both sulphate of potash and sulphate of magnesia reduce the amount of lime in the soil very extensively, and may have the effect of ultimately producing acid conditions. With regard to other interactions, it has been pointed out by Dr. Russell, of Rothamsted, that sulphate of potash to a certain extent injures the texture of the soil. It reacts with calcium carbonate to produce potassium carbonate, which is, like sodium carbonate, a powerful deflocculent.

Concerning the effect of sulphate of potash and of muriate of potash on the soil organisms little can be said in the present state of our knowledge. Acid conditions in the soil certainly have the most depressing effect on the activity of the nitrifying bacteria. On the other hand, it has been shown by Dr. Russell that compounds which generate antiseptic properties may, by limited application to the soil, promote the development of the nitrifying bacteria by destroying the Amœboid organisms which prey upon them.

A good deal has been said recently about the effect of sulphate of potash-magnesia in promoting increased growth, but so far as can be shown, this result is, for the most part, indirect, the magnesia having the effect of setting free from the soil a certain amount of potash and other essential plant foods. The same advantage can be claimed for common salt, and many other compounds much cheaper than magnesia. The use of the sulphate of potash-magnesia can therefore be discounted until extensive trials have been made in this country to show that it can be used on a paying basis.

As shown by the results of experimental trials, the advantage at the present time seems to lie with muriate of potash for three reasons : (1) In being a much cheaper form of potash, (2) in producing heavier yields of saleable potatoes, and (3) in being suitable for the majority of soils.

Death of Professor Odling

WE regret to record the death, which has taken place in his 92nd year, of Professor William Odling, M.B., F.R.S., a chemist of European reputation.

Educated at private schools, Dr. Odling was intended for the medical profession, and after the usual student's course at Guy's Hospital, he graduated M.B. at the University of London so long ago as 1851. His natural bent, however (a writer in the *Daily Telegraph* states), was not for medicine, but for chemistry. In this sphere he was so successful that he was appointed Demonstrator in Chemistry at Guy's in 1850, and 13 years later Lecturer on Chemistry at St. Bartholomew's Hospital. Meantime, he had succeeded by original research in gaining the Fellowship of the Royal Society in 1859. His first published work appeared two years later, a "Manual of Chemistry, Descriptive and Theoretical," in 1866 there followed "Lectures on Animal Chemistry," and three years later "Outlines of Chemistry." Meanwhile, the Fullerian Professorship of Chemistry had fallen vacant by the retirement in 1868 of Edward Frankland, and Dr. Odling was elected to the chair, which has been held by such men as Faraday, Tyndall, and Dewar. He held the Fullerian Professorship until 1873, having in the meantime, in 1872, been appointed Waynflete Professor of Chemistry in the University of Oxford, a position which he retained until 1912. During the five years he spent at the Royal Institution, Odling's researches were concerned with simple organic compounds; ammonia compounds of platinum; the manufacture of chlorine; the qualities of indium—at that time, 1872, "the last new metal"; the history of ozone, and questions of evaporation and diffusion.

In one of his lectures at the Royal Institution he produced some hydrogen gas, extracted from a meteorite. For periods incalculable the meteor had doubtless wandered in space, until at last it fell to earth, and delivered to the chemist its occluded gas. At the lecture on Friday, June 4, 1869, the Prince of Wales, afterwards King Edward VII., presided. The subject was "Simple Organic Compounds," a severely technical discourse, but possibly made interesting in the delivery. Dr. Odling devoted one of his addresses to the quasi-defence of the theory of phlogiston—"the inflammable principle" of the older chemists. Hydrogen and oxygen combine and form water, and Lavoisier showed that the weight of the water exactly equals the weight of the constituents, without addition or loss of any "inflammable principle"; but, said Professor Odling, the oxygen and hydrogen in their combination gave out a large amount of energy, and that energy was what the old chemists meant by phlogiston. Unfortunately, their ideas of energy were obscure; they regarded heat as imponderable matter, and their phlogistic notions befogged chemistry for two centuries or more. Dr. Odling was the British judge of awards at the Philadelphia Exhibition of 1876, for chemical manufactures, and for many years he was one of the analysts employed to test the London water supply. He was a Fellow of Worcester College, Oxford, and among the foreign honours of which he was the recipient was the honorary degree of Doctor of Mathematics and Physics conferred upon him by the University of Leyden in 1875.

Society of Chemical Industry

Edinburgh and East of Scotland Section

THE monthly meeting of the Edinburgh and East of Scotland Section of the Society of Chemical Industry was held in the hall of the Pharmaceutical Society of Great Britain, Edinburgh, on February 15, Dr. Jordan (president) in the chair.

A paper was read by Mr. W. N. Stokoe, of Craigmillar Creamery Company, on "Rancidity in Butter, Margarine and Butter Fats." Mr. Stokoe said that of all the problems which those concerned in the manufacture of butter fats had to face the question of rancidity in raw materials or the finished article was most acute. Rancidity occurred in a short time in spite of the meticulous care of the manufacturer. It was of paramount importance that this problem should be carefully studied and thorough insight gained into the conditions causing rancidity. The nature of the chemical changes was but little understood.

Rancidity in Commercial Oil

The chief causes of rancidity in commercial oils were the action of moisture, air and light, assisted by traces of lipolytic ferments which might be present in the fats and oils. Generally speaking, vegetable oils and fats were free from those ferments owing to the high temperature to which the oil was subjected during the process of refinement. Animal fats being rendered at a low temperature contained traces of these ferments. The first stage in the development of hydrolysis might be very slight and scarcely noticeable. It had been said that microbism was the cause of rancidity in pure fats, but that was not the case. Micro-organisms played no part in rancidity.

Samples of pure fats had been procured and inoculated with these organisms and they quickly died. The kinds or forms of rancidity were several and might be classified into divisions, dependent largely on microscopic appearance, odour and taste. The first division consisted of fat having a greasy taste and smell but not discoloured or visibly affected in any way. The next form was what he called the perfume form. It had a malignant odour and the taste was vile and might occur in margarine only a few days old. It occurred in margarine containing cocoa-nut and palm kernal oils and was caused by enzymes secreted by the moulds of penicillium, glaucum and aspargillium species. Other common moulds caused hydrolysis, but not the perfume form of rancidity. The substances which caused the perfume form consisted chiefly of methyl nonyl ketone accompanied by other ketones.

Causes of Discoloration

Mr. Stokoe described his investigations with a number of these organisms and said that only the cocoa-nut and palm kernal media produced the strong perfume in question. The next form was that in which there was marked discoloration of butter or margarine. It might appear in black marks or patches of blue which spread to pink to red areas. Sometimes one form predominated and sometimes another or they might occur together in the same sample of these fats. All these effects existed upon the growth of the micro-organisms and in some they caused moulds and in others bacteria. The black patches, as a rule, did not exist to any depth, but were merely surface organisms.

There were quite a number of other organisms to be found in butter or margarine. In general it was impossible to dogmatise definitely on the changes produced by the organisms and in many cases owing to insufficient description it was difficult to identify the organism found.

Contamination might very easily take place in the utensils or machinery. Storing or transport in wooden containers was utterly wrong and the canvas used on the bungs simply teemed with mould spores.

The paper used for sending out butter or margarine should be sterilised, but one had yet to find a paper completely sterile. The margarine manufacturers lot was not a happy one owing to the merciless persecution of these numberless minute enemies. Nothing but the utmost care, bacteriological cleanliness and sterilising of materials could ever help him to put out butter as a product which would keep its clean taste for a reasonable time.

The lecture was illustrated by diagrams on the screen showing a large number of the organisms. A discussion followed, in which Mr. G. F. Merson, Dr. Lauder, Mr. B. D. W. Luff and Mr. C. Norman Kemp took part.

Newcastle Section

Two papers were read by Dr. A. A. Hall and Mr. Hoare Collins at the last meeting of the Newcastle section of the Society of Chemical Industry. The attendance was a good one, and in the absence of the Chairman of the section, Dr. J. H. Paterson, the meeting was informally opened and Dr. A. A. Hall read his paper, on "A Quick Volumetric Method for the Estimation of Mercury," in which he said that that method consisted of taking a known volume of the mercury solution, adding excess of an ammonium salt then excess of standard alkali. The mercury was then precipitated as "white precipitate." It was then made up to a known volume with water, filtered through a dry filter and an alignot part taken of the filtrate and titrated with standard acid, using methyl orange as an indicator. The difference between the acid and alkali taken gave the amount of alkali used in precipitating the mercury. That method was applicable to soluble mercuric salts and could be used in the presence of any substance not acted upon by caustic soda.

Mr. S. Hoare Collins then read a paper on "Fractional Distillation Columns." He exhibited a spiral glass fitting for fractioning columns used in separating liquids by distillation. The method of making the glass spirals was demonstrated and the results of distillations tabulated. From those observations it was shown that the glass spiral was exceedingly simple to make and very efficient in use.

During the short discussion which followed Mr. Hoare Collins pointed out that "choking" in use was quite under control. All that was needed was more open spirals. In practice a stock of spirals of various sizes and of different pitch could be kept, and the spiral could be suited to the needs of the substance undergoing distillation. Generally speaking, high boiling liquids would need more open spirals. Spirals with a pitch of one turn per 1½cm. were about the best for all round work.

Nottingham Section

At the meeting on February 16 the President of the Society gave the members of the section an account of the scientific aspects of colour photography. He then discussed the recent improvements in the pan-chromatic plate. We had become accustomed to the contrasts of the ordinary photograph which were quite false as judged by visual standards. The problem was to make the sensitivity, wave length curve of the plate correspond with that of the eye, and this was solved by the use of coloured sensitisers on the plate such as eosin, ethyl red and pinaverold, &c., introduced by Meister, Lucius & Brüning, together with a green or yellow colour screen.

Panchromatic plates had a special importance in aerial photography on account of the selective absorption of the blue end of the spectrum by great thicknesses of hazy air. Thus plates sensitive to the red end of the spectrum showed much greater detail than those sensitive to the blue only. The production both of these dyes and of their parent substances was in the hands of the Germans, and there was danger of a serious shortage. It had been found possible, however, in England to discover the nature of these dyestuffs, to manufacture them on a large scale and to produce the extra rapid plates which were necessary. In former plates the speed ratio in the red to the blue region was 2.75 to 1, but plates had now been prepared the speed ratio of which was 0.75 to 1.

An Industrial Entente

The Press Association understands that a number of French business experts are shortly to visit London to complete negotiations for what is called "an industrial entente." France finds herself in possession of considerable supplies of raw potash in Alsace, but she is without the PROCESS PLANT required to transmute the raw material into the higher forms of chemicals of which chloride of potash is the basis. Great Britain possesses this essential plant, and it is proposed to combine the two. Mr. Kenneth Chance, of the British Cyanide Company, Ltd., has recently visited Alsace in connection with the negotiations, and additional works may be erected in East Anglia.

An Interesting Evening at the Chemical Industry Club

THE monthly open meetings of members at the Chemical Industry Club are proving attractive, and one of the most interesting was held on Monday evening, when Mr. W. Cullen gave an address on "South Africa," based upon some 20 years' residence in the Colony and a close acquaintance especially with the explosives and metallurgical industries. Mr. F. E. Hamer presided.

Mr. Cullen, after a brief sketch of the political and racial history of the Colony, dealt with its principal industries—sugar, fruit, ostrich farming, wine production, mining and explosives. Incidentally he mentioned that he could find no trace of any paper on the metallurgy of South Africa since one read before the Society of Chemical Industry about 1893. As regards this industry, he said that its problems were mainly engineering, rather than chemical, and that gold mining especially had been greatly simplified since the discovery of the cyanide process. An important development was the establishment of a mint at Pretoria with local refineries. South African gold was at present shipped to England for assay and refinement, but if this work was done on the spot it would mean the establishment in South Africa of the largest gold mint in the world. It need hardly be pointed out that a large mining industry must have attached to it a large explosives industry, and this in South Africa had attained considerable dimensions. Another industry which had considerable promise was the production of tanning material. Formerly wattle bark, which produced a very fine tanning extract, was shipped in the crude state to England, Germany and elsewhere. Now the bark was treated in South Africa and the extract reduced to hard blocks, which employed local labour and greatly facilitated shipment. It was not generally known that there was a considerable whale-fishery off the South African coast, and Lever Brothers had a large number of works engaged in the refining of the oil for various purposes. The general impression left by the address was one of the great possibilities for the future development of the Colony.

A discussion followed in which Mr. Hutchinson, Dr. Ormandy, Mr. Chapman, Captain Goodwin and others took part.

At the close Mr. Coley, the hon. secretary, announced that at the next monthly meeting, on Monday, March 21, Mr. W. J. U. Woolcock, M.P., would "have a chat" with the members.

Nitrate v. Artificial Nitrogenous Products

Effect of a Producers' Combine

SPEAKING at a recent meeting of the Pan de Azucar Nitrate Co., Ltd., the hon. H. C. Gibbs said that although it was said that the price of nitrate should be kept low to meet the competition of sulphate of ammonia and artificial nitrogenous products, there was much less in that contention than might be supposed. With regard to artificial nitrogenous products, very little was yet known of the cost, and although the quantity being produced in Germany was now considerable, it was by no means certain that if German currency should improve materially, it would be able to compete with nitrate.

Assuming, however, that the cost would be very low and the possible production very large, it might be supposed that when the world recovered from the immediate effects of the war, the demand for fertilizers would be very great, and might easily overtake any probable supply. With regard to sulphate of ammonia from coke ovens, it was a by-product which was always sold at a price below that of nitrate as measured in terms of nitrogen, however low the price of nitrate might be and it could not compete with nitrate at any price after a certain stage in the growth of the plant, because it was too slow in its effect to be of any value. A very good feature of the present situation from the producers' point of view was the formation of a combination among the holders of nitrate stocks, because it helped to keep prices steady and to avoid a breakdown in the market; and, further, because, should the association desire it, they could discuss the immediate future with a solid body of buyers, who controlled practically all the existing channels of distribution other than those in the United States of America.

Air Filters

Advantages of Wet Filtration

POSSESSING many marked advantages over the original dry air filters, wet filters, which are distinguished from those of the dry type by the adoption of a liquid as the cleansing medium, are rapidly coming into general use. In a new form of apparatus which has been introduced by Heenan & Froude, Ltd., of Worcester, the filtering effect is obtained by forcing the air through two sets of metallic wool screens fitted one behind the other in the front part of the filter. A continuous flow of water is passed over the screens by a small centrifugal pump, fitted at the side of the filter.

After percolating through the screens the water falls into the tank at the base of the filter, where it passes through a strainer and returns to the pump to be re-circulated. Having passed through the screens the air passes a series of fixed eliminators, fitted at a convenient distance from the screens, which catch any particles of free moisture that may have passed the second screen. This process, in addition to cleansing the air, reduces its temperature to within a few degrees of the prevailing wet bulb temperature.

Another popular type of filter is the patent Invincible (Wet) Air Filter, which is manufactured by William Grice & Sons, Ltd., of Fazeley Street, Birmingham. In this filter the air passes upward through a large number of plates placed closely together, and which are kept continually wet and act in a similar way to the "gills" of a fish. All impurities in the air are deposited on the plates and washed down by the water which is constantly supplied to maintain the plates in a wet state. The air, in passing between the plates, becomes reduced in temperature and also attains a high degree of saturation. After passing through the filtering plates the air is led into a sheet iron ducting which conveys it wherever it is required. In the ducting bend leading from the filter a set of special elimination plates prevent the possibility of free moisture being drawn over with the filtered air. The internal bearings of the filter are *lignum vitæ* (end grain), and are automatically lubricated by the water, no oil being used.

The filter itself, in relation to the quantity of purified air it will deliver per minute, is of such a size and character that it can be placed in almost any convenient position. An apparatus measuring not more than 9 ft. 9 in. in diameter by 11 ft. high, is capable of delivering up to 50,000 cubic ft. of purified air per minute.

Ammonia Plant

Paper by G. Keville-Davis

THE sixth lecture of the course on Chemical Engineering at the Manchester Municipal College of Technology was given on February 17, by Mr. G. Keville-Davis, M.Sc., the subject being Ammonia Plant.

The lecturer, after giving figures to show the commercial importance of ammonia and ammonium compounds, dealt with the materials used in the construction of ammonia plant. He stated that cast-iron was the best, although in many cases when not exposed to ammonium chloride or nitrate, wrought-iron could be used. Cast-iron coils should always be used in the condensers for making ammonia concentrate. Copper could not under any circumstances be used in ammonia plant. The problem of the efficient absorption of ammonia from the crude gas was not an easy one to solve, the ammonia content of the gas being so relatively small.

With regard to the distillation of ammonia, the lecturer explained the theoretical consideration which made the use of the column still so efficient and necessary. The general type of still was fully explained and illustrated. After touching upon the manufacture of ammonia concentrate, the lecturer dealt with the manufacture of sulphate of ammonia, with special reference to the details of construction and working of the saturators.

Liquor ammonia formerly made entirely from chloride or sulphate of ammonia could be made by the direct distillation of gas liquor. A plant which could be used either for the production of liquor ammonia or of sulphate of ammonia was explained in detail. The absorbers for the liquor ammonia were constructed of wrought iron throughout, as, owing to the purity of the gas, there was no action on the iron and a considerable economy in cooling water could be effected.

Profiteering Committee and "Middleman"

Chemical Merchants' Defence of Traders

THE Chemical and Dyestuff Traders' Association are in correspondence with the Profiteering Act Central Committee in reference to the Conference on Irregular Trading and the inquiry now going on into the distribution of commodities through ordinary trading channels. With respect to a table of transactions prepared by the committee, and described as "typical," in which "a commodity in general use passed through twelve hands before reaching the customer," it is pointed out by the Association that the committee do not state what the commodity is, where the transactions took place, or out of what total number of transactions this particular one has been selected, while the date of the first transaction is entered as "unknown." After commenting upon the vagueness of the particulars and the danger of generalising from abnormal incidents, the Association state :—

"Any attempt to develop a concerted attack on the merchant trading section of the community would be greatly and generally resented, especially if it is done in a way that might create a prejudice against them by bringing out abnormal transactions from an abnormal period without regard to the fact that such abnormal conditions produced a hotbed from which all sorts of mushroom growths sprang up. Many of these growths had a brief but very expansive life. At times it looked as though they were rather encouraged than exterminated by the controls. But now that trade is approximating to a sound base again and to a more nearly normal price level, it will be found that legitimate traders and merchants will once again play a valuable and indeed essential part in the effort to regain and maintain our commercial supremacy at home and abroad.

"Furthermore, it would be found upon investigation that the trader or merchant is upon an average quite content with a margin of profit that makes him as a distributing medium far less costly as he is certainly far more efficient than any other means would be either to the makers or to the consumers. If by "middleman" the Conference means the speculator or exploiter, by all means exterminate him, and our Association will gladly assist. If, however, by "middleman" the Conference means the merchant trader, then assist and encourage him if trade is to be revived."

Finsbury College Chemical Society

THE annual dinner was held at the Connaught Rooms on Friday evening, February 18. The President (Mr. A. J. Hale, F.I.C.) presided, and amongst those present were Professor G. T. Morgan, F.R.S., Professor Margetson, Mr. J. H. Coste, Mr. C. R. Darling and Dr. H. M. Atkinson.

The President, in welcoming the visitors, expressed the great pleasure the Society felt at the number of former students present, and hoped that ultimately the function might develop into a re-union between the past and present chemical students of the College. It gave especial pleasure to the members to be able to welcome Professor Morgan and Mr. Coste, both old students, who were doing so much for the College in its present difficult time.

Mr. Coste, in proposing the toast of the College, referred to the splendid work which had been done in the past, and how every effort was being made by the Finsbury Technical College Defence Committee, and by various institutes and societies, to prevent the threatened closing of the College. Until the authorities definitely decided to keep the College open, Mr. Coste urged that no effort to gain that end should be relaxed by those interested. This view was warmly supported by Professor Morgan. Attention was also called to the plea to keep open the College recently made by Sir Oliver Lodge in the columns of *Nature*.

Mr. Darling expressed a hope that, in the event of the College remaining open, the curriculum would not be altered or its freedom interfered with in any way. In the course of his travels about the country he had everywhere come upon old students of the College occupying responsible positions, and this he attributed to the fact that the whole course of the training at the College tended to turn out men possessing initiative, and not merely possessing theoretical book knowledge.

Chemical Matters in Parliament

Dyestuffs Act

SIR P. LLOYD-GREAME, replying to Major Barnes (House of Commons, February 21), said that it had not been decided, under the Dyestuffs Act, only to allow goods to be imported when the applicant had a definite order. He did not think that people applying for licences had been asked to state the persons to whom the imported goods would be delivered, but he thought that they might have been told that it would facilitate the granting of licences if it was clear that they were ordered for people who required them.

List of Prohibited Products

Sir William Bull asked the President of the Board of Trade (House of Commons, February 21) why the list of prohibited goods under the Dyestuffs Act is issued secretly to the Customs Authorities but withheld from the traders, who are greatly incommoded thereby?

In reply, Sir P. Lloyd-Greame said a provisional list of commodities covered by the Dyestuffs (Import Regulation) Act was furnished to the Customs for their guidance pending the preparation of a full and detailed list in consultation with the Licensing Committee. This list had now been completed and was in the hands of the printers, and would be generally available shortly. He did not think that any appreciable amount of inconvenience had been caused to importers by the slight delay which had occurred, as all inquiries as to whether any particular commodity is or is not included have been answered immediately.

Replying to a further question by Major Barnes, he said the list when published would be identical with the one which has been furnished to the Customs and Excise and that it would be issued to everyone concerned.

Licences for Salicylic Acids

Major Barnes (House of Commons, February 21) asked the President of the Board of Trade if an import licence for two hundredweight of salicylic acid (B.P.) required for the purpose of making medicated ointment has been refused.

Sir P. Lloyd-Greame: I understand from the Dyestuffs Advisory Licensing Committee that the applicants in the case referred to are being informed that, if they can satisfy the Committee that the consignment is of B.P quality and is to be used solely for medicinal purposes, and will undertake to produce proof, if required later, that it has been so used, the Committee will be prepared to reconsider their decision.

Rewards for Inventors

New Committee on Patents

THE Lord President of the Council has established an Inter-Departmental Committee on Patents, with the following terms of reference: "1. To consider the methods of dealing with inventions made by workers aided or maintained from public funds, whether such workers be engaged (a) as research workers, or (b) in some other technical capacity, so as to give a fair reward to the inventor and thus encourage further effort, to secure the utilisation in industry of suitable inventions and to protect the national interests; and 2, to outline a course of procedure in respect of inventions arising out of State-aided or supported work, which shall further these aims and be suitable for adoption by all Government departments concerned." As at present constituted, the committee consists of the following members: Mr. Kenneth Lee, LL.D. (chairman), Mr. W. St. D. Jenkins, C.B.E., Mr. F. E. Smith, O.B.E., F.R.S., Air Vice-Marshal Sir E. L. Ellington, K.C.B., C.M.G., C.B.E., Mr. H. W. W. McAnally, C.B., Mr. P. W. L. Ashley, C.B., Colonel W. H. D. Clark, O.B.E., Sir H. Frank Heath, K.C.B., Mr. A. J. Stubbs, M.Inst.C.E., M.I.E.E., Mr. H. H. Dale, C.B.E., M.D., F.R.S., Mr. W. J. Coombes, Lieut.-Colonel P. K. Lewes, C.M.G., D.S.O., R.A., Mr. P. Tindal Robertson, Sir R. A. Gregory, F.R.A.S., Mr. D. M. Kerly, K.G., the Hon. Sir Charles A. Parsons, K.C.B., LL.D., D.Sc., F.R.S.

The secretary to the committee is Mr. A. Abbott, to whom all communications should be addressed, at 16 and 18, Old Queen-street, Westminster, London, S.W.1.

Last year the Tennessee Copper & Chemical Co., U.S.A., produced 333,629 tons of SULPHURIC ACID.

From Week to Week

THE CHEMICAL WORKS of Morris, Little & Son, Ltd., West Stockwith, have been closed down.

PRICE, STUTFIELD & CO., LTD., chemical merchants, 6, Fenchurch Buildings, London, E.C.3, announce that their telephone number is now Bank 457.

Reports that British or Japanese capital is being introduced into the CHILIAN NITRATE INDUSTRY have been officially denied.

A TRUCK CONTAINING CHEMICALS burst into flames on the railway at Maesycwmmer, South Wales, on February 19, and was destroyed.

MR. HENRY PULLMAN has been elected a director of the British Gas Light Co. in place of Mr. R. S. Gardiner, who resigned on account of ill health.

Mr. P. H. RESS, of the firm of W. A. Ross & Brother, of New York, and Old Leeds Street, Liverpool, dyestuffs importers, is in England upon business matters.

Barnsley Education Committee are considering a proposal for the ESTABLISHMENT OF A CHEMISTRY AND PHYSICS CENTRE in connection with the technical school.

We inadvertently omitted to state that an article on "Industrial Alcohol," published in our columns on January 15, was quoted from "Chemical Age." (U.S.A.)

ANILINE DYES are now being made in Czecho-Slavakia by the Aussig Chemical Co., at Usto, and by Kinziberger & Co. at Prague; but the industry is not on a firm basis.

The price of "Public Health Chemical Analysis" (Constable & Co., Ltd.), which was reviewed in THE CHEMICAL AGE of January 29, should have been given as 21s., instead of 10s. 6d.

The death occurred on February 18, through heart failure, of MR. FREDERICK WALKER who was Chairman of the Premier Oil Co., Ltd., the New Lafon Tin Fields, Ltd., and other industrial undertakings.

MR. G. W. MAUDE, head chemist to Hovey & Lowther, Ltd., phosphoric acid makers, and Hopol, Ltd., polish material manufacturers, of Sandbach, Cheshire, has been elected a Fellow of the Chemical Society.

THE KARL ZEISS WORKS at Jena, where employment has been slack for some time past, are now working at full capacity, as are the works of the Goerz Company, which has recently increased its capital to 28,000,000 marks.

As a result of an arrangement made between large MANUFACTURERS OF EXPLOSIVES IN SOUTH AFRICA, exports on an extensive scale are now being made to Australia and Madagascar.

DR. CLAYTON, a director of the United Alkali Co., has been adopted as the prospective Conservative candidate for the Widnes Parliamentary Division, in opposition to Mr. A. Henderson, M.P.

The Danish Industrial Council has approved of the USE OF YELLOW COLOURING IN THE MANUFACTURE OF MARGARINE, and it is anticipated that the Minister of Agriculture will take the matter up.

The officials of the Marley Hill Chemical Co. held their first annual WHIST DRIVE and dance recently. Prizes were awarded to Miss E. Cawthorn and Miss M. Coulthard, and to Messrs. Wm. Douglas and Jas. Brabban. Sealed prizes were awarded to Miss L. Lawson and Mr. Robt. Rowell.

Engaged in cleaning out a vat at the Bath Brewery on February 19, a workman named Chivers was OVERCOME BY FUMES and asphyxiated. Despite the use of a smoke helmet, firemen who were summoned were unable to enter the vat, and the body was got out with a grappling pole.

In a recent report on the NITRATE MARKET, Henry Bath & Son, Ltd., state that the arrangement lately made among almost all the European nitrate importers to unify prices has already done something to restore confidence, and that it seems likely that the effect of this will grow with time.

With a view to establishing closer relations with CONSUMERS OF DYES IN THE UNITED STATES, the Society of Chemical Industry in Basle has decided to enlarge the Ciba Co., Incorporated, New York, and has taken over the Aniline Dyes & Chemicals, Incorporated.

A strike of SCOTTISH DYE WORKERS has been averted. The employers proposed to reduce the wages of employees of 20 years of age and under by amounts ranging from 1s. 6d. to 9s. 10d. per week as from the first pay in March, and the union threatened a strike. The parties have now agreed to arbitration, with Sir Thomas Munro as arbitrator.

Mr. Charles Macdonald, Chief Inspector under the Petroleum Acts in Glasgow, has submitted his report on the EXPLOSION OF ACETYLENE GAS CYLINDERS at the premises of the Atlas Welding Co., Hillhead, to the Glasgow magistrates. The report is not in favour of the registration of premises in which the cylinders are kept.

Provision for the supervision and CONTROL OF THERAPEUTIC SUBSTANCES which cannot be tested adequately by chemical means is recommended by a Ministry of Health Departmental Committee, presided over by Sir Mackenzie Chalmers. The substances in question include vaccines, sera, toxins, antitoxins, and analogous products, salvarsan and its analogues, and various drugs.

Mr. Leonard Harvey, of 25, Victoria Street, Westminster, who has during the past few years made a special study of pulverised coal applications and uses, and has been representing an American firm as European manager, informs us that he is relinquishing this position and proposes to carry out his original intention of practising as a consulting engineer upon matters pertaining to pulverised coal and colloidal oil, at the address mentioned.

THE COUNCIL OF THE UNIVERSITY OF BIRMINGHAM, who are appealing for £500,000, report that nearly £300,000 has been raised, special tribute being paid to the public spirit and generous contributions of the great oil corporations. Liberal support has also come from J. & E. Sturge, Ltd., chemical manufacturers; Southall Bros. & Barclay, chemists; Docker Bros., varnish and colour makers; and F. & C. Osler, Ltd., glass manufacturers.

Last Saturday the BY-PRODUCT PLANT of the Glamorgan Collieries, Llwynypia, closed down for an indefinite period. By the withdrawal of fires for 48 hours the ovens became so damaged that even were a sudden revival of trade to come, about a considerable time would be occupied in repairing the ovens before they could be used. The ovens at the Welsh Navigation Collieries, Coed Ely, and the United National Collieries are also closed down, and all the coking plants in the Rhondda Valley are "on stop."

On February 19, fifty members of the Newcastle-on-Tyne Section of the Society of Chemical Industry visited the works of the Team By-Product Co., Ltd. at Dunston-on Tyne, and were received by Messrs. A. W. Reichwald and J. Currie. The plant comprises 130 Otto regenerative coke ovens, combined with a direct process for the recovery of tar, ammonia and other by-products. The visitors were afterwards entertained to tea, when Dr. J. H. Paterson suitably expressed their thanks for the courtesy and hospitality shown them.

Pre-War Chemical Contracts

Annulment Action Succeeds

MR. JUSTICE ROWLATT, sitting as Commercial Judge in the King's Bench Division on February 18, heard an action brought by Messrs. J. Coppee and others, of Brussels, against Blagden, Waugh & Co., of Coronation House, Lloyds Avenue, in respect of a declaration which they asked for the certain pre-war contracts for benzol and naphtha were void. Plaintiffs, who carry on business in Belgium, made large contracts in 1914 for deliveries of the commodity in question up to the end of 1918.

Plantiffs, who still carry on business in Belgium, raised the point that the whole of the contracts were void by reason of the British proclamation of September, 1915, the plaintiffs being in territory occupied by the enemy, trading with them was forbidden. They also pleaded that under Courts Emergency Powers Act the Court was able to annul contracts of this character. They further contended that the factories under which the original contract was founded had been partially destroyed by the Germans and important fittings had been scrapped.

His Lordship, after hearing the arguments, said he could not think that this contract could possibly be carried out, having regard to the devastation of that part of Brussels in which the plaintiffs carried on business and the way in which the contract was drawn, and he felt he must give judgment for plaintiffs with costs.

References to Current Literature

British

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SUGARS. Refining raw sugars without bone-black. C. E. Coates. *J. Ind. Eng. Chem.*, February, 1921, pp. 147-153.

COLLOIDS. Research problems in colloid chemistry.—II. W. D. Bancroft. *J. Ind. Eng. Chem.*, February, 1921, pp. 153-158.

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German

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WAX. The Montan wax of the Central German Coal. R. Pschorr and K. J. Pfaff. *Ber.*, November 13, 1920, pp. 2147-2162.

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GAS. The gasification of peat and wood. B. Waeser. *Z. angew. Chem.*, February 15, 1921, pp. 51-54.

FATS. The splitting of fats. H. Japhé. *Z. angew. Chem.*, February 1, 1921, pp. 35-37.

COLLOIDS. Colloid mills and their use in technical chemistry. B. Block. *Z. angew. Chem.*, January 25, 1921, pp. 25-30.

ELECTRO-CHEMISTRY. Electrolytic oxidation of methyl and ethyl alcohol in alkaline solution; electrolytic formation of methane. E. Müller and A. R. Miro. *Z. Elektrochem.*, February 1, 1921, pp. 54-57.

DYES. Galloflavine. J. Herzig. *Annalen*. October 26, 1920, pp. 247-282.

While following his employment at the MOND NICKEL WORKS on January 28, Evan Williams, fitters' helper, sustained serious injuries to his right leg through walking into an uncovered sump. He died subsequently in Swansea Hospital, and at the inquest last week a verdict was returned that death was due to toxemia following injuries accidentally received.

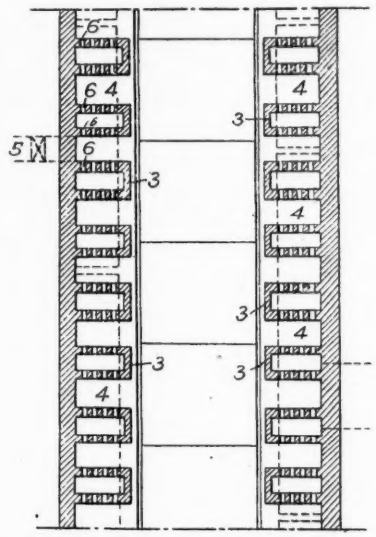
SOUTH WALES PATENT FUEL MANUFACTURERS, meeting at Cardiff on February 17 under the presidency of Mr. T. Hughes Rice, Swansea, decided to fix minimum prices for the sale of their product, thus following the example of the Coalowners' Association. The price schedule, which ranges from 54s. to 50s. per ton f.o.b., will be revised at periodical meetings of a committee formed of representatives of each patent fuel concern.

Patent Literature

Abstracts of Complete Specifications

157,474-5. TUNNEL FURNACES, KILNS, OVENS AND THE LIKE. H. Francart, 72, Beckwith Road, Herne Hill, London. Application date, December 19, 1918.

157,474. Dryers, tunnels, and tunnel ovens of the muffle type are provided with transverse hollow flanges projecting internally, to increase the heating surface. The furnace is shown in longitudinal sectional plan and the flanges 3 extend from one side to the other around the roof, while the internal spaces are connected at each end to horizontal flues extending longitudinally along the furnace below the ends of the hollow flanges. Gaseous fuel enters into a series of flanges at 5, and



157,474

air for combustion passes into the flanges through openings 6 communicating with the interior of the kiln. Combustion takes place in the hollow flanges and the vertical cavities 4 are thus heated and a circulation of hot gas is produced within the furnace, while heat is also radiated directly from the flanges 3 to the material within the furnace. In a modification the hollow flanges are provided with short pipes extending across and through them and communicating with the spaces on either side. The pipes are inclined downwards from the entrance of the furnace towards the outlet so that the gas in the pipes tends to move upwards and consequently in the direction of the entrance to the furnace.

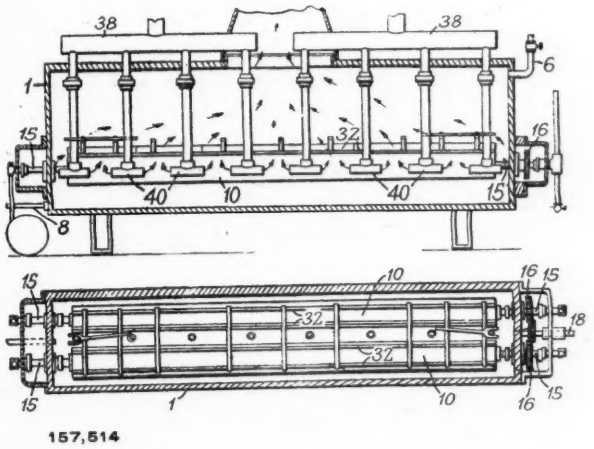
157,475. In a furnace of the type described in 157,474 above, the internally projecting flanges are made solid instead of hollow. The combustible gas is admitted into a longitudinal channel below the ends of the flanges and rises through openings in the floor into the spaces between the flanges. The lower ends of the flanges are cut away to provide lateral communication between the spaces on either side. The flanges may be inclined from the bottom upwards in the direction of the entrance of the oven so that the upward movement of the products of combustion between the flanges causes a general movement of the gas in the oven towards the entrance. If the tunnel is of the low-roofed type the flanges are prolonged below the level of the sole of the oven to obtain a sufficient height to cause the necessary circulation of gas.

157,490. EMULSIONS AND THE LIKE, TREATMENT OF. W. Broadbridge, 62, London Wall, London, E.C.2, E. Edser, 3, Hillyfields Crescent, Brockley, London, S.E.4, and Minerals Separation, Ltd., 62, London Wall, London, E.C.2. Application dates, July 18 and August 12, 1919.

The object is to obtain a separation and recovery of certain constituents from liquid or semi-liquid suspensions in liquids such as emulsions by a treatment similar to the froth-flotation process for the concentration of ores. The process is particularly applicable to the recovery of wool-fat from wool-washing effluent. It is found by experiment that when such an emulsion is treated by mechanical agitation and aeration that (1) the selection of the "values" depends on the extent of the air-liquid surface of the gas bubbles, and consequently on the extent of the subdivision of the gas; (2) the necessary subdivision of the gas is best effected by mechanical agitation; (3) a certain minimum time of contact between the gas and the emulsion is necessary. The agitation and aeration of the liquid are produced by a mechanical beater rotating at the bottom of a tank on a vertical axis. The mixture passes through an opening in the side of the tank into another tank where the liquid is quiescent, so that the froth containing the "values" rises to the top and then overflows into a launder. The lower part of the latter tank is connected by a pipe to the bottom of the aeration tank so that a circulation of the liquid is obtained, while a branch pipe is connected to the bottom of the next aeration vessel of a series so that a proportion of the liquid is transferred to it for further treatment. In a modification the beater is placed immediately below a grid consisting of several series of horizontal bars at right angles, and the finely divided material rises through the grid into a larger vessel provided with inclined baffles which form separating compartments for the froth. The emulsion may be treated at 20°-30°C., and to assist the formation of froth, a frothing and modifying agent such as amyl alcohol soap or saponin may also be added.

157,514. HEAT TREATMENT OR EVAPORATION OF LIQUIDS, PROCESS OF AND APPARATUS FOR. J. F. Ruff, 2,487, Military Avenue, Port Huron, Mich., U.S.A. Application date, October 6, 1919.

The apparatus is of the type in which films of liquid are heated by contact with the external surface of a submerged rotating drum. Liquid is continuously supplied by the pipe 6 to the vat 1 and drawn off by the pipe 8. Each heating cylinder comprises a shell 10 supported on hollow shafts 15 through which steam is supplied to heat the cylinder. Each shaft carries a toothed wheel 16 by means of which it may be



157,514

rotated from a common shaft 18. Condensed water is deposited on the internal surface of the shell by centrifugal force, and is then forced out through radial passages by the pressure of steam, so that the temperature of the walls is continuously maintained. The solid material deposited on the cylinders is continuously removed by scrapers 32, and a relatively large quantity of air is continuously injected into the liquid by nozzles 40 adjacent to the heating drums to prevent adhesion of the liquid to the surface of the drum. The nozzles 40 are supplied in groups from headers 38.

157,554. LEAD SULPHATE DIRECT FROM LEAD SULPHIDE ORES, PROCESS OF MAKING. P. A. Mackay, 70, Lombard Street, London. Application date, October 18, 1919.

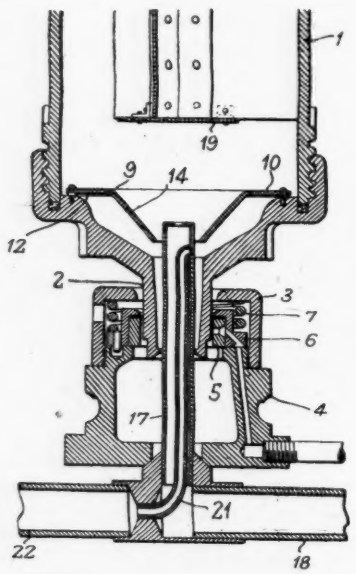
The object is to produce lead sulphate at a comparatively low cost from lead sulphide ores free from or containing traces only of zinc, such as galena. The ore is finely ground and gradually added to an excess of oleum, when a strong exothermic reaction takes place which generates sufficient heat to convert the galena into lead sulphate without the application of external heat. The excess of oleum is used to reduce the consistency of the emulsion and expedite the reaction. The bulk of the lead sulphate is precipitated, and any further sulphate in solution is obtained by the addition of water.

157,555. VANADIUM FROM ITS ORES, METHOD OF RECOVERING. P. A. Mackay, 70, Lombard Street, London. Application date, October 18, 1919.

Lead vanadate is treated with oleum, with the formation of lead sulphate and liberation of vanadium pentoxide V_2O_5. Sulphur dioxide or hydrochloric acid gas is passed through the mixture to reduce the vanadium pentoxide to tetroxide V_2O_4, which then combines with sulphuric acid to form vanadyl sulphate, which is soluble in water. The lead sulphate is precipitated by adding water and removed, and the solution may then be neutralised by adding alkali or alkaline carbonate to form and precipitate hypovanadic acid. Alternatively, the vanadyl sulphate may be oxidised by electrolysis to V_2O_5. The reduction previously mentioned may be effected by adding a carbonaceous material to the acid solution, which liberates sulphur dioxide.

157,688. CENTRIFUGAL MACHINE. P. T. Sharples, St. Davids, Pa., U.S.A. Application date, June 22, 1920.

In separating mixtures containing viscous or adhesive heavy constituents a carrier liquid is also employed which does not mix with the substance to be separated but keeps it from contact with the bowl of the centrifuge. The apparatus is for introducing the carrier liquid to its proper zone within the bowl. A suspended revolving bowl, 1, is provided with an



157,688

axial extension at the bottom which is surrounded by a hollow member, 3, screwed on to a stationary bearing, 4. A spiral spring, 7, a ferrule, 6, and a bushing, 5, are arranged within the member, 3, as shown. A diaphragm, 9, having an annular part, 10, and conical part, 14, is fixed to the bottom of the bowl so that a narrow circular passage, 12, is provided leading into the bowl. The mixture to be separated is supplied through the pipes, 18, 17, to the interior of the bowl, and the carrier liquid is supplied by the pipes, 22, 21 to the space below the diaphragm, 9, from which it passes into its proper zone in the bowl without mixing with the other liquid. A spreader plate, 19, is provided immediately below the nozzle, 17.

NOTE.—Specification 144,727 (Elektro-Osmose Akt.-Ges., Graf Schwerin Ges.), which is now accepted, was abstracted when it became open to inspection under the International Convention. It relates to a process for decolorising liquids containing glycerine. (*See* THE CHEMICAL AGE, Vol. III., p. 214.)

157,578. DI-ETHYL SULPHATE, PREPARATION AND MANUFACTURE OF. N. V. Sidgwick, Lincoln College, Oxford University, S. G. P. Plant, St. John's College, Oxford University, and A. Boake Roberts & Co., Ltd., 100, Carpenters Road, Stratford, London. Application date, October 30, 1919.

Sulphuric acid containing 80-100 per cent. H_2SO_4, or oleum containing 90 per cent. SO_3 is treated with ethylene gas or a mixture of ethylene and air at a temperature of about 75°C., but not exceeding 120°C. Preferably a large excess of gas containing 90-100 per cent. of ethylene is used and is passed into the acid until the absorption is more than 20 per cent. of the weight of the acid. Under these conditions a yield of about 30 per cent. of di-ethyl sulphate is obtained. Alternatively, instead of using sulphuric acid as the starting material, ethyl hydrogen sulphate may be used. The di-ethyl sulphate may be separated from its mixture with ethyl hydrogen sulphate, sulphuric acid, and ethyl alcohol, by extraction with benzene, ligroin, ether, or other immiscible solvent. Alternatively, the mixture is poured into an excess of water, in which case the di-ethyl sulphate separates as an oily layer at the bottom.

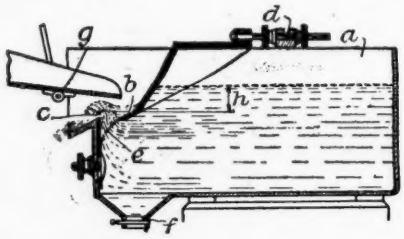
International Specifications not yet Accepted

155,546. Thiophene derivatives. H. Scheibler, 14, Hortensienstrasse, Lichterfelde, near Berlin. International Convention date, November 24, 1915. Addition to 155,259. (*See* THE CHEMICAL AGE, Vol. IV., p. 230).

Oils prepared as described in 155,259 are treated in addition with sodium, sodamide, or sodium and dry ammonia gas. The final treatment requires only small amounts of alkyl magnesium halide.

155,570. SEPARATING MATERIALS. H. Velten, 2, Mahndorfer Chaussee, Halberstadt, Germany. International Convention date, December 12, 1919.

Water in a tank *a* is maintained under a head *h*, and overflows between a vertical wall *c*, and a slide *b*. The wall *c* is adjustable vertically and the slide *b* horizontally to vary the



155,570

opening. Material to be classified is shaken from a trough *g* into the water above the slide *b*, so that the particles are projected into the rising stream of water at right angles. The lighter particles are carried over by the water, and the heavier are deposited in the tank *a* and are withdrawn through the outlet *f*.

155,572. ZINC MANUFACTURE. R. Seiffert, 59, Heidkamperstrasse, Berg-Gladbach, Germany. International Convention date, December 12, 1919.

In the manufacture of zinc the muffle and the collecting chamber for the zinc dust are connected by a short tapering passage of smaller diameter than the mouth of the muffle or the collecting chamber, and the latter may be increased in size. The yield of zinc dust is thereby increased.

LATEST NOTIFICATIONS.

158,852. Manufacture of tar. Barrett Co. February 7, 1920.
158,876. Automatic apparatus for raising or forcing liquids. Morin, A. February 7, 1920.
158,863. Method of producing sodium bicarbonate and hydrogen. Nitrogen Corporation. February 7, 1920.
158,875. Method and apparatus for distilling coal and like products. Ab-Der-Halden, C. February 9, 1920.
158,558. Manufacture of a new diethylbar-bituric acid compound. Chemische Fabrik Auf Actien (vorm E. Schering) Der Vorstand. January 26, 1920.
158,562. Bearing metal alloy of high lead content. Goldschmidt-Akt.-Ges., T. January 26, 1920.
158,827. Alloys and process of treating same. Pacz, A. February 13, 1920.
158,577. Rotary pumps or motors. Irwin & Jones, Ltd. January 28, 1920.
158,831. Rotary pumps or motors. Irwin & Jones, Ltd. February 3, 1920.
158,837. Porcess and apparatus for expanding metal shells. Bliss Co., E. W. February 19, 1920.
158,844. Process of squeezing oils and fats from oily and fatty substances, and device for working such process. Fankhauser, C. A. February 3, 1920.
158,846. Coke door machines. American Coke & Chemical Co. February 2, 1920.
158,849. Synthesis of Ammonia. Soc. L'Air Liquide (Soc. Anon. Pour L'Etude et L'Exploitation Des Procedes. G. Claude.) February 2, 1920.

Specifications Accepted, with Date of Application

128,895. Sodium sulphate and ammonium sulphate, Separation of the double salt sodium-ammonium sulphate into. Société Industrielle de Produits Chimiques. June 22, 1918. Addition to 15,756/1918.
130,974. Coke ovens. Société de Fours à Coke et d'Entreprises Industrielle. August 9, 1918.
132,269. Suction gas generators. W. E. Scrivener. September 6, 1918.
133,972. Pyroxylin compositions. E. I. Du Pont de Nemours & Co. March 16, 1918.
134,536. Selenium and noble metals from electrolytic slimes and the like, Process for recovering. M. Chikashige and D. Uno. October 28, 1918.
154,170. Hydrochloric acid used in the manufacture of glucose, Process of and apparatus for regenerating. H. Terrisse and M. Levy. November 15, 1919.
157,051. Electric-furnaces. Société Metallurgique du Frayol. January 7, 1920.
158,288. Hydrogen sulphide from sulphurous gases, Process for the production of. J. G. Macleod. (W. J. Browning). July 31, 1919.
158,293. Alunite ore, Utilisation of. A. Matheson. August 28, 1919.
158,320. Ores and other materials, Method of and means for treating finely crushed. E. T. Middlemiss. October 29, 1919.
158,337. Coal tar, Process of treating. W. Anderson and J. Meikle. October 31, 1919.
158,387. Filters. J. Miller and G. Fletcher & Co., Ltd. November 7, 1919.
158,394. Carbonaceous material, Apparatus for distilling. W. P Perry. November 10, 1919.
158,409. Producer-gas plants, Generators for. T. H. White. November 14, 1919.
158,447. Phenolic bodies with aldehydic compounds, Condensation of. Vickers, Ltd., Ioco Rubber and Waterproofing Co., Ltd., and W. H. Nuttall. December 15, 1919.
158,497. Filtering-apparatus. J. G. McKean and R. F. Jones. September 10, 1920.
158,498. Water, Treatment of—for softening, sterilising, and like purposes. H. J. Magrath. September 13, 1920.
158,499. Continuous kilns of the tunnel type. R. C. Metcalfe. September 16, 1920.

Applications for Patents

Andrews, W. O. Means for quantitative detection of carbon dioxide and combustible gases containing carbon. 5,654. February 18.
Atack, F. W. Manufacture of anthraquinone or its derivatives. 5,672. February 19.
Badische Anilin & Soda Fabrik. Process for purifying gases. 5,127. February 14.
Bakelite Ges. Manufacture of condensation products from phenols and aldehydes. 5,257. February 15. (Germany, March 1, 1920.)
Bassett, L. P. Process for extraction of metals or metalloids from their oxides. 5,752. February 19. (France, February 20, 1920.)
Bassett, L. P. Manufacture of sulphides of alkaline and earthly-alkaline metals. 5,753. February 19. (France, February 20, 1920.)
Bell Bros., Ltd., Lowe, H. M., and Roelojsen., J. A. Process for treating acid tar from washing benzol, &c., for recovery of sulphuric acid, &c. 5,647. February 18.
Brat, P. Recovery of nitrogen from peat, &c. 5,518-5,519. February 17. (Germany, February 18, 1920.)
Dutt, E. E. and P. C. Process for preparation of titanium dioxide and alumina from bauxite. 5,626. February 18.
Glysyn Corporation. Chlorination of hydrocarbons. 5,665. February 18. (United States, August 31, 1920.)
Guignard, G. P. Process for extraction of atmospheric nitrogen from nitrogen compounds of titanium. 5,108. February 14. (France, March 19, 1920.)
Haege, T. Production of fertilisers containing phosphoric acid and potash. 5,195. February 15.
Johnson, J. Y. (*Badische Anilin & Soda Fabrik*). Process for purifying gases. 5,127. February 14.
Rheinisch-Nassauische Bergwerks-und Hütten-Akt.-Ges., Spieker, A. Method of extracting zinc from lead slags, zinc-retort residues, poor zinc ores, &c. 5,472. February 17. (Germany, March 17, 1920.)
Rollason, A. Carbonisation of coal. 5,035. February 14.
Stevenson, W. J. Manufacture of artificial silk for acetyl cellulose. 5,044. February 14.
Straatman, J. F. Process for decolorising liquids. 5,656. February 18. (Holland, Dec. 3, 1920.)
" Process for decolorising liquids. 5,765. February 19. (Holland, January 13.)
Techno-Chemical Laboratories, Ltd. Drying. 5,353. February 16.
" Evaporators, &c. 5,488. February 17.
" Heating processes. 5,489. February 17.
Victoria Falls & Transvaal Power Co., Ltd. Means for quantitative detection of carbon dioxide and combustible gases containing carbon. 5,654. February 18.
Zdanowich, J. O. Process for manufacture of artificial silk, horse-hair, &c., from cellulose acetates. 5,318. February 16.
" Process for manufacture of films, sheets, &c., from cellulose acetates. 5,319. February 16.
Zinke, A. Manufacture of perylene. 5,103. February 14. (Austria, July 2, 1920.)
" Manufacture of dioxyperylene. 5,104. February 14. (Austria, July 2, 1920.)

Patents Court Cases

Notice has been given of an application under Rule 7 of the Patents (Treaty of Peace) Rules, 1920, by Scottish Dyes, Ltd., of Murrell Hill Works, Carlisle, for a license in respect of Patent 1,425/14 relating to the manufacture of vat colouring matters of the anthracene series. This patent is in the name of J. Y. Johnson (Badische Anilin and Soda Fabrik). Any notice of opposition must be given by March 10, 1921.

Application has been made for the following patents to be endorsed: "Licences of Right," under Section 24 of the Patents and Designs Acts, 1907 and 1919: 19,792/1914 (concentration of nitric acid); 124,191 (production of pure concentrated nitric acid and tetroxide of nitrogen); 126,951 (metallurgical reduction processes); 129,974 (ammonium nitrate fertilizers); 132,496 (fertilizers containing nitrogen and phosphoric acid); and 134,207 (crystallisation from solutions). All these are in the name of Norsk Hydro-Elektrisk Kvaelstofaktieselskab.

Some Great Chemists

LECTURING before the Newcastle Chemical Industry Club last week on "Some Great Men in Chemistry," Dr. F. C. Garrett dealt in reminiscent style with Roscoe, the gifted Professor of Chemistry at Manchester, who earned the title of "Father" of that University; Schorlemmer, his famous associate; Bunsen, inventor of the burner associated with his name, and the latter's successor at Heidelberg, Victor Meyer, one of the most distinguished German chemists; and of two distinguished English chemists, who are still living—H. E. Armstrong and Sir William Pope, the latter Professor of Chemistry at Cambridge. Dr. Garrett mentioned the fact that Sir William Pope, whom he described as the greatest living chemist, had a local connection, inasmuch as his maternal grandfather was a Prudhoe man. Roscoe, Schorlemmer, Meyer and Armstrong were,, he said, his teachers; while Sir William Pope was a former fellow-student, and still a close personal friend.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co. and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.*

Market Report

THURSDAY, February 24.

There have been comparatively few changes in value during the past week, but business remains exceedingly quiet, and there are few signs of an early improvement. There is a certain export inquiry, but little of it leads to business.

General Chemicals

ACETONE.—Stocks are passing steadily into consumption; price unchanged.

ACID ACETIC.—There appears to be a certain amount of realisation at prices which are not justified by the first-hand market. When these parcels are cleared there is reason to anticipate an upward tendency in price.

ACID CARBOLIC.—Practically no business is doing and the article favours buyers.

ACID CITRIC remains a second-hand market, and buyers are able to secure concessions in price.

ACID FORMIC.—The demand is practically dead and the quotation is purely nominal.

ACID OXALIC remains in poor demand at recent values.

ACID TARTARIC is cheaper and the tendency is easy for both spot and forward.

BLEACHING POWDER is uninteresting. There are many sellers and few buyers.

COPPER SULPHATE.—No improvement in the situation is reported, and the demand is only nominal.

FORMALDEHYDE is in slow demand, but the limited stocks are in strong hands.

LEAD ACETATE retains its firmer tendency, but only a small business is passing.

LITHOPONE has been in better demand; price unchanged.

MAGNESIUM SALTS remain without feature.

POTASH CARBONATE AND CAUSTIC.—Both demand and price remain quite nominal.

POTASH PRUSSIATE has been in better inquiry, but buyers' limits are generally too low.

SALAMMONIAC is in inquiry on export account, but only a small business has been concluded.

SODA ACETATE is in good demand; the price is inclined to be a little firmer.

SODA BICHROMATE is depressed on realisation of stocks, but an improvement is expected at an early date.

SODA CAUSTIC is in very poor demand and the tendency remains easy.

SODA HYPOSULPHITE is rather lower in price, but inquiry is improving.

SODA NITRITE.—The tendency is decidedly better and stocks are small.

SODA PRUSSIATE.—The price remains unsatisfactory to the manufacturers, and any increase in demand would quickly affect the market.

Coal Tar Intermediates

There is little feature to report. Trade is proceeding slowly with little variation in prices. There is practically no business on export account.

ALPHA NAPHTHOL is in quiet demand, but makers' price is maintained.

ANILINE OIL AND SALT is in somewhat better inquiry on export account, but very little business has so far been transacted.

BETA NAPHTHOL is without feature, and the price appears to have stabilised on the present figure.

DIMETHYLANILINE is weak in the absence of any sustained demand.

DINITROCHLORBENZOL is in slightly better request, and the price is maintained.

DIPHENYLAMINE is only in small request, but stocks are light.

NITROBENZOL is moving off slowly and the price is maintained.

PARANITRANILINE is only in small demand, and the price is inclined to be weak.

PARAPHENYLENEDIAMINE is in steady demand at last quoted figures.

PARATOLUIDINE is on offer, but there are few buyers.

SALICYLIC ACID remains stagnant with the market in buyers' favour.

SULPHANILIC ACID is easy, with little business to report.

Coal Tar Products

Our market is quiet for most coal tar products, and prices in most cases are more or less nominal.

90% BENZOL is quiet, and is quoted from 2s. 6d. to 2s. 8d. on rails in the North, and 2s. 9d. to 2s. 11d. in the South.

PURE BENZOL can be bought at 2s. 9d. to 3s. per gallon.

CREOSOTE OIL is in very fair demand for prompt delivery, and is quoted at 11d. to 11½d. in the North, and 1s. to 1s. 1d. in the South.

CRESYLIC ACID is very dull, and is worth 2s. 9d. to 3s. for the Pale quality, 97/99 per cent., while the Dark, 95/97 per cent. is quoted at 2s. 6d.

SOLVENT NAPHTHA is weak, and is quoted at 2s. 4d.

HEAVY NAPHTHA is slightly better at about 2s. 9d.

NAPHTHALENE.—Crude qualities remain very weak at from £8 to £14 per ton. Refined is slightly better, and is quoted £28 to £30 per ton.

PITCH.—The position remains unchanged. Buyers are still scarce, and very little business has been reported recently. Prices still have a downward tendency, and in view of the absence of business it is exceedingly difficult to give present market values.

Sulphate of Ammonia

There is a somewhat better demand both for home trade and export, but export prices still have a downward tendency.

Current Prices

Chemicals

	per	£	s.	d.		£	s.	d.
Acetic anhydride	lb.	0	2	6	to	0	2	9
Acetone oil	ton	90	0	0	to	95	0	0
Acetone, pure	ton	100	0	0	to	105	0	0
Acid, Acetic, glacial, 99-100%	ton	70	0	0	to	72	0	0
Acetic, 80% pure	ton	53	0	0	to	54	0	0
Arsenic	ton	100	0	0	to	105	0	0
Boric, cryst.	ton	72	10	0	to	74	0	0
Carbolic, cryst. 39-40%	lb.	0	0	9	to	0	0	9½
Citric	lb.	0	2	4	to	0	2	6
Formic, 80%	ton	80	0	0	to	85	0	0
Gallic, pure	lb.	0	4	9	to	0	5	0
Hydrofluoric	lb.	0	0	8½	to	0	0	9
Lactic, 50 vol.	ton	42	10	0	to	43	10	0
Lactic, 60 vol.	ton	47	10	0	to	50	0	0
Nitric, 80 Tw.	ton	41	0	0	to	44	0	0
Oxalic	lb.	0	1	0	to	0	1	1
Phosphoric, 1.5	ton	65	0	0	to	67	0	0
Pyrogallic, cryst	lb.	0	9	6	to	0	9	9
Salicylic, Technical	lb.	0	1	6	to	0	1	8
Salicylic, B.P.	lb.	0	1	4	to	0	1	6
Sulphuric, 92-93%	ton	8	10	0	to	8	15	0
Tannic, commercial	lb.	0	3	6	to	0	3	9
Tartaric	lb.	0	1	10	to	0	2	0
Alum, lump	ton	18	0	0	to	18	10	0
Alum, chrome	ton	45	0	0	to	50	0	0
Alumino ferric	ton	9	0	0	to	9	10	0
Aluminium, sulphate, 14-15%	ton	13	0	0	to	14	0	0
Aluminium, sulphate, 17-18%	ton	15	5	0	to	16	0	0
Ammonia, anhydrous.	lb.	0	2	2	to	0	2	4
Ammonia, .880	ton	43	0	0	to	45	0	0
Ammonia, .920	ton	30	0	0	to	32	10	0
Ammonia, carbonate	lb.	0	0	4	to		—	

	per	£	s.	d.		£	s.	d.
Ammonia, chloride	ton	85	0	0	to	90	0	0
Ammonia, muriate (galvanisers)	ton	57	10	0	to	60	0	0
Ammonia, nitrate	ton	55	0	0	to	60	0	0
Ammonia, phosphate	ton	95	0	0	to	100	0	0
Ammonia, sulphocyanide	lb.	0	3	0	to	0	3	3
Amyl acetate	ton	420	0	0	to	425	0	0
Arsenic, white, powdered	ton	77	10	0	to	80	0	0
Barium, carbonate, 92-94%	ton	12	10	0	to	13	0	0
Barium, chlorate	lb.	0	0	11	to	0	1	0
Chloride	ton	21	0	0	to	23	0	0
Nitrate	ton	55	0	0	to	56	0	0
Barium Sulphate, blanc fixe, dry	ton	30	0	0	to	31	0	8
Sulphate, blanc fixe, pulp	ton	16	10	0	to	17	0	0
Sulphocyanide, 95%	lb.	0	1	6	to	0	1	0
Bleaching powder, 35-37%	ton	22	0	0	to	23	0	0
Borax crystals	ton	39	0	0	to	41	0	0
Calcium acetate, Brown	ton	15	0	0	to	17	0	0
,, Grey	ton	23	0	0	to	25	0	0
Calcium Carbide	ton	29	0	0	to	30	0	0
Chloride	ton	12	10	0	to	13	0	0
Carbon bisulphide	ton	65	0	0	to	67	0	0
Casein, technical	ton	90	0	0	to	92	0	0
Cerium oxalate	lb.	0	3	9	to	0	4	0
Chromium acetate	lb.	0	1	2	to	0	1	4
Cobalt acetate	lb.	0	11	6	to	0	12	6
Oxide, black	lb.	0	16	0	to	0	16	6
Copper chloride	lb.	0	1	3	to	0	1	6
Sulphate	ton	39	0	0	to	40	0	0
Cream Tartar, 98-100%	ton	200	0	0	to	210	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde 40% vol	ton	130	0	0	to	135	0	0
Formusol (Rongalite)	lb.	0	4	9	to	0	5	1
Glauber salts	ton	Nominal.						
Glycerine, crude	ton	70	0	0	to	72	10	0
Hydrogen peroxide, 12 vols.	gal.	0	2	8	to	0	2	9
Iron perchloride	ton	50	0	0	to	52	0	0
Iron sulphate (Copperas)	ton	4	0	0	to	4	5	0
Lead acetate, white	ton	58	0	0	to	60	0	0
Carbonate (White Lead)	ton	47	0	0	to	50	0	0
Nitrate	ton	62	10	0	to	65	0	0
Litharge	ton	53	0	0	to	55	0	0
Lithopone, 30%	ton	37	10	0	to	40	0	0
Magnesium chloride	ton	15	10	0	to	16	10	0
Carbonate, light	cwt.	2	15	0	to	3	0	0
Sulphate (Epsom salts commercial)	ton	12	10	0	to	13	0	0
Sulphate (Druggists')	ton	18	10	0	to	19	10	0
Manganese, Borate	ton	190	0	0	to		—	
Sulphate	ton	130	0	0	to	135	0	0
Methyl acetone	ton	95	0	0	to	100	0	0
Alcohol, 1% acetone	gall.	Nominal.						
Nickel sulphate, single salt	ton	60	0	0	to	62	0	0
Nickel ammonium sulphate, double salt	ton	62	0	0	to	64	0	0
Potassium bichromate	lb.	0	1	1	to		—	
Carbonate, 90%	ton	85	0	0	to	90	0	0
Chloride	ton	50	0	0	to	52	0	0
Chlorate	lb.	0	0	8½	to	0	0	9
Meta bisulphite, 50-52%	ton	290	0	0	to	205	0	0
Nitrate, refined	ton	63	0	0	to	65	0	0
Permanganate	lb.	0	2	6	to	0	2	9
Prussiate, red	lb.	0	2	6	to	0	2	9
Prussiate, yellow	lb.	0	1	6	to	0	1	7
Sulphate, 90%	ton	31	0	0	to	33	0	0
Salammoniac, firsts	cwt.	5	0	0	to		—	
Seconds	cwt.	4	15	0	to		—	
Sodium acetate	ton	45	0	0	to	47	10	0
Arsenate, 45%	ton	60	0	0	to	62	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	9½	to	0	0	10
Bisulphite, 60-62%	ton	37	10	0	to	40	0	0
Chlorate	lb.	0	0	5½	to	0	0	5½
Caustic, 70%	ton	27	0	0	to	28	0	0
Caustic, 76%	ton	28	0	0	to	29	0	0
Hydrosulphite, powder, 85%	lb.	0	2	3	to	0	2	6
Hyposulphite, commercial	ton	26	0	0	to	27	0	0
Nitrite, 96-98%	ton	60	0	0	to	62	0	0
Phosphate, crystal	ton	32	0	0	to	35	0	0
Perborate	lb.	0	2	2	to	0	2	4
Prussiate	lb.	0	0	8½	to	0	0	9
Sulphide, crystals	ton	22	0	0	to	25	0	0
Sulphide, solid, 60-62%	ton	45	0	0	to	47	0	0
Sulphite, cryst.	ton	15	0	0	to	16	0	0
Strontium carbonate	ton	85	0	0	to	90	0	0
Strontium Nitrate	ton	90	0	0	to	95	0	0
Strontium Sulphate, white	ton	8	10	0	to	10	0	0
Sulphur chloride	ton	42	0	0	to	44	10	0
Sulphur, Flowers	ton	19	0	0	to	19	10	0
Roll	ton	19	0	0	to	19	10	0

	per	£	s.	d.		£	s.	d.
Tartar emetic	lb.	0	2	6	to	0	2	9
Tin perchloride, 33%	lb.	0	2	6	to	0	2	7
Perchloride, solid	lb.	0	3	0	to	0	3	3
Protochloride (tin crystals)	lb.	0	2	0	to	0	2	1
Zinc chloride, 102 Tw.	ton	22	0	0	to	23	10	0
Chloride, solid, 96-98%	ton	60	0	0	to	65	0	0
Oxide, 99%	ton	45	0	0	to	47	10	0
Dust, 90%	ton	90	0	0	to	92	10	0
Sulphate	ton	21	10	0	to	23	10	0

Coal Tar Intermediates, &c.

Alphanaphthol, crude	lb.	0	4	0	to	0	4	3
Alphanaphthol, refined	lb.	0	4	6	to	0	4	9
Alphanaphthylamine	lb.	0	3	3	to	0	3	6
Aniline oil, drums extra	lb.	0	1	8	to	0	1	9
Aniline salts	lb.	0	1	10	to	0	2	0
Anthracene, 85-90%	lb.		—		to		—	
Benzaldehyde (free of chlorine)	lb.	0	5	3	to	0	5	6
Benzidine, base	lb.	0	11	6	to	0	12	0
Benzidine, sulphate	lb.	0	10	0	to	0	10	6
Benzoic acid	lb.	0	2	6	to	0	2	9
Benzoate of soda	lb.	0	2	3	to	0	2	6
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol benzoate	lb.	0	9	6	to	0	10	0
Betanaphthol	lb.	0	3	0	to	0	3	3
Betanaphthylamine, technical	lb.	0	11	6	to	0	12	6
Croceine Acid, 100% basis	lb	0	5	0	to	0	6	3
Dichlorbenzol	lb.	0	0	9	to	0	0	10
Diethylaniline	lb.	0	6	9	to	0	7	6
Dinitrobenzol	lb.	0	1	5	to	0	1	6
Dinitrochlorbenzol	lb.	0	1	5	to	0	1	6
Dinitronaphthaline	lb.	0	1	6	to	0	1	8
Dinitrotoluol	lb.	0	1	8	to	0	1	9
Dinitrophenol	lb.	0	3	0	to	0	3	3
Dimethylaniline	lb.	0	5	9	to	0	6	0
Diphenylamine	lb.	0	5	0	to	0	5	3
H-Acid	lb.	0	10	0	to	0	10	6
Metaphenylenediamine	lb.	0	5	9	to	0	6	0
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	7	6	to	0	8	6
Monosulphonic Acid (2:7)	lb.	0	7	6	to	0	8	0
Naphthionic acid, crude	lb.	0	4	0	to	0	4	3
Naphthionate of Soda	lb.	0	4	3	to	0	4	6
Naphthylamin-di-sulphonic-acid	lb.	0	5	0	to	0	5	6
Nitronaphthalene	lb.	0	1	6	to	0	1	8
Nitrotoluol	lb.	0	1	4	to	0	1	5
Orthoamidophenol, base	lb.	0	18	0	to	1	0	0
Orthodichlorbenzol	lb.	0	1	1	to	0	1	2
Orthotoluidine	lb.	0	2	3	to	0	2	6
Orthonitrotoluol	lb.	0	1	3	to	0	1	4
Para-amidophenol, base	lb.	0	12	6	to	0	13	0
Para-amidophenol, hydrochlor	lb	0	13	0	to	0	13	6
Paradichlorbenzol	lb.	0	0	7	to	0	0	8
Paranitraniline	lb.	0	6	6	to	0	7	0
Paranitrophenol	lb.	0	2	9	to	0	3	0
Paranitrotoluol	lb.	0	5	9	to	0	6	0
Paraphenylenediamine, distilled	lb.	0	13	6	to	0	14	6
Paratoluidine	lb.	0	8	3	to	0	8	6
Phthalic anhydride	lb.	0	4	9	to	0	5	0
Resorcin, technical	lb.	0	7	6	to	0	8	6
Resorcin, pure	lb.	0	9	6	to	0	10	0
Salol	lb.	0	4	0	to	0	4	3
Sulphanilic acid, crude	lb.	0	1	8	to	0	1	9
Tolidine, base	lb.	0	8	6	to	0	10	0
Tolidine, mixture	lb.	0	2	9	to	0	3	0

Cardiff By-Products

	WEDNESDAY
Sulphate of Ammonia—	
For home consumption (per ton o.t.)	£24 3s. 6d.
For export (per ton f.o.b.)	£20 to £30
National Benzol (per gallon)	3s. to 3s. 6d.
Solvent Naphtha (per gallon)	2s. 8d. to 2s. 10d.
Heavy Naphtha (per gallon)	3s. 2d. to 3s. 3d.
Crude Naphthalene Salts (per ton)	£9 to £15
Pitch (per ton)	130s. to 140s.
Creosote (per gallon)	1s. to 1s. 1d.
Motor Benzol (per gallon)	3s. 2d. to 3s. 7d.
Crude Benzol (per gallon)	1s. 9d. to 2s.
Toluol (per gallon)	4s.

In an article in the *Vie en Chemin de Fer*, M. Desmarest, discussing the problem of the world need for petroleum, expresses the belief that it will not be long before the discovery of how to make synthetic petroleum solves the difficulty. M. Desmarest sees no reason why the MANUFACTURE OF SYNTHETIC PETROLEUM should not be practicable.

Company News

BRITISH DYESTUFFS CORPORATION.—Dividend on preferred ordinary at the rate of 8 per cent. per annum, less tax.

DJAPOERA (SUMATRA) RUBBER.—The profit for year to August 31 last was £12,374, and £2,265 was brought in, making £14,639. To depreciation, £1,148; directors' extra remuneration, £619; forward, subject to income, corporation profits, and Netherlands Indies taxes, £12,872.

ANGLO-PERSIAN OIL.—At an extraordinary general meeting of the Anglo-Persian Oil Co., Ltd., held on Tuesday, Sir Charles Greenway, Bart., presiding, it was unanimously agreed to give the directors power to create £10,000,000 of Second Preference shares to rank both as regards dividend and capital after the existing preference shares, and to create a further £5,000,000 of first preference shares, ranking *pari passu* with those already issued.

RELIANCE FUEL.—The report to Dec. 31 last states that since the formation of the company the time has been occupied in constructional work and the erection of plant at Llanelly. Despite adverse conditions it is stated that the difficulties have been satisfactorily surmounted, and the output of ovoid briquettes is expected to commence by the end of the month. In extension of the original scheme the directors decided to erect a special loading wharf adjacent to the fuel works, which will not only greatly facilitate the export of the company's products, but should be a source of additional revenue by reason of the charges which will be levied on steamers using the wharf. To meet the extra expenditure on the works an issue of unallotted shares will probably be decided upon. In that event a prior opportunity of subscribing for such shares will be given to existing shareholders. The directors, having every confidence in the undertaking, have meantime provided the necessary funds. Meeting, River Plate House, E.C., Feb. 28, noon.

BRADFORD DYERS' ASSOCIATION.—The accounts for the year 1920 state that after charging £614,942 for repairs and renewals, the net profit, after making estimated provision for the employés' bonus register, income tax, E.P.D., corporation profits tax, and other contingencies, amounts to £954,265, and £397,321 was brought in, making £1,351,566. From this sum have to be deducted auditors' remuneration, legal and other professional charges, £3,670; interest on debenture stock, £58,150; depreciation on English and Scotch plants, motor vehicles, furniture and fixtures, £231,102; amount transferred to investments contingency fund, £100,000; leaving £958,664. Dividends have been paid on the preference shares for the year amounting to £125,000 and on the ordinary shares to June 30 last at the rate of 1s. per share, amounting to £67,824. Out of the remaining balance of £765,840, it is recommended that there be allocated to employés' benefit funds £180,000; that a dividend on the ordinary shares at the rate of 3s. per share be paid for six months to Dec. 31, making 4s. per share for the year, requiring £203,471, and that £402,369 be carried forward. The dividend on the ordinary shares will be paid on March 7.

Sulphate of Soda Dispute

Short Delivery Claim Fails

IN the King's Bench Division on February 17, Mr. Justice Rowlatt, sitting as Commercial Judge, heard an action brought by W. Barnes & Co. (London), Ltd., of Cheapside, against Messrs. Wallington & Co., of Tokenhouse Yard, to recover damages for a shortage of delivery of a quantity of sulphate of soda and soda ash. Defendants denied all liability.

Plaintiffs' case was, in 1920 a member of the defendant firm, who was acting as a liquidator of a company had some 40 tons of sulphate of soda and 4½ tons of soda ash to sell as a job lot. The price offered and agreed to was thirty shillings a ton for the sulphate and £4 for the soda ash. The goods were bought at a hopelessly small price for this reason, as the prices on the market rose to £13 or £13, while the ash went to a rate from £20 to £23.

The sold notes, however, contained the words "approximately" in connection with the quantity of goods to be delivered.

His Lordship said it was obvious this sale was one of a job lot, and judgment must be entered for the defendants with costs.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIALS.	REF. No.
Montreal ...	Indian linseed oil; varnish. Replies to the High Commission for Canada, 19, Victoria Street, London, S.W.1	250
South Africa...	Rubber goods	222
Bridgetown, Barbados	Glassware	224
Morocco ...	Glassware	235
Boston ...	Rubber goods	238

Tariff Changes

BRITISH INDIA.—Revised tariff valuation for goods imported into British India are published in the *Board of Trade Journal* (February 17, pp. 186-193). Among the goods affected are green copperas; alum (lump); soda ash and crescent alkali; bicarbonate of soda; caustic soda (solid, flake and powdered); and all other sorts of chemical products and preparations not otherwise specified; dyes including alizarine, and aniline, and certain colours; and glass and glassware of all sorts; when imported by the owner of a cotton weaving mill and proved to be for use in the weaving of cotton or the baling of woven cotton goods, the following goods may be imported free of duty: Aniline blue, bisulphate of soda, china clay, chloride of magnesium, chloride of zinc, glycerine substitutes, and soda ash.

MALTA.—Paraffin and stearine are now exempted from the payment of import duty.

AUSTRIA.—The following are among the goods which, subject to certain exemptions, require an import licence (*see Board of Trade Journal*, February 17, p. 195-7): Essential oils; coal tar oils of the benzol class having a specific gravity up to 0·950; mineral oils, lignite tar and schist tar, raw or refined; hollow glass, fine; zinc; liquid ammonia; hydrochloric, nitric and sulphuric acids; sulphate of ammonia; calcium carbide; chloride of zinc; substitutes for soap; methyl alcohol; acetone, concentrated acetic acid; and explosives. Export licences are required for dyeing and tanning materials of all kinds, except dyewoods; mineral oils, lignite and pitch tars; wares of magnesite; nickel anodes; wares of platinum for scientific or industrial use; fertilisers; explosives and blasting materials of all kinds; acetone; methyl alcohol; acetate of lime; calcium carbide; nitric, hydrochloric, sulphuric, chloro-sulphonic, and pyroligneous acids, and a number of other chemical substances and products.

FRANCE.—The exportation and re-exportation from France of dephosphorisation slag, except under licence remains prohibited, and an export duty of Fr.1.50 per 100 kilogs gross has now been imposed. The duty is to be applied to all consignments for which export licences are granted, but is not to be applied to consignments exported to the French colonies, possessions and protectorates.

Recent Wills

Mr. R. Burtles, of Manchester, glass manufacturer £15,341

Mr. H. Voss, of Malmsmead, Woodcote Lane, Purley, joint managing director of the Pacific Phosphate Co., Ltd., a naturalised British subject £60,628

Mr. J. Ferguson, of The Knowe, Bearsden, and of 9, Cadogan Street, Glasgow, distiller, of Messrs James Ferguson & Sons. His holding in various descriptions of war stocks amounts to £53,792, his interest in the Burmah Oil Co., Ltd., to £12,870, in the Shell Transport & Trading Co., Ltd., to £11,838 ... ... £233,884

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

London Gazette

Partnership Dissolved

HARBORD, F. W., and BOLT, F. J., metallurgists, analytical and consulting chemists, at 16, Victoria-street, Westminster, and 6, Finsbury Square, London, under the style of Edward Riley and Harbord, by mutual consent as from December 31, 1919. All debts received and paid by F. W. Harbord, who will in future carry on the business.

Application for Discharge

HEESCH, E. E. F., at 158, Woodsley-road, and formerly carrying on business at 212, Wellington-street, as Manufacturer's Agent, now residing at 59, Clarendon-road, and carrying on business at Stansfield Mill Yard, 77 and 79, Kirkstall-road, all in the city of Leeds, as Oxy Acetylene Welder and Chemical Manufacturer, under the style of the Gatap Company. Court, Leeds. Date of Order, December 13, 1920. Ordered that the bankrupt be discharged, subject to the following condition, to be fulfilled before his discharge takes effect, namely, he shall, before the signing of this Order, consent to judgment being entered against him for the sum of £50, payable forthwith, being part of the balance of the debts provable in the bankruptcy which is not satisfied at the date of this Order, and for £1 10s., cost of judgment.

Companies Winding Up Voluntarily

MIDDLESEX CHEMICAL AND MACHINERY CO., LTD. Gilbert Page, 26, Overton Drive, Wanstead, Liquidator.

MITCHELITE PETROL AIR GAS SYSTEM CO., LTD.—J. W. Purvis, Great Tomkyns, Upminster Common, Essex, Liquidator.

Liquidators' Notices

ANGLO-CALIFORNIAN OIL SYNDICATE, LTD.—A meeting of creditors will be held at 23, Gerrard Street, London, W.1, on February 28, at 11 a.m. H. J. Hardy, Liquidator

DROITWICH SALT CO., LTD.—A general meeting of members will be held at 24, North St. John Street, Liverpool, on March 21, at 12 noon. C. Hewetson Nelson, Liquidator.

OVEX FUEL CO., LTD (in liquidation).—A general meeting of members will be held at 3-5, Crown Court, Old Broad Street, London, E.C., on Tuesday, March 29, at 11.30 a.m. C. Williamson Milne, Liquidator.

WEST NORFOLK FARMERS' MANURE AND CHEMICAL CO., LTD.—A general meeting will be held at the offices of the Company, King's Lynn, on March 22, at 3 p.m. J. Brown, Liquidator.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, created after July 1, 1908, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges which would, if created after July 1, 1908, require registration. The following Mortgages and Charges have been so registered. In each case the total debt, as specified, in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced since such date.]*

CELLULOID AND COLLODION PRODUCTS CO., LTD., London, W.C.—Registered February 9, equitable mortgage securing all moneys due or to become due to Barclays Bank, Ltd.; charged on lease of factory and premises, 124, Kilmorie Road, Forest Hill. *Nil. April 21, 1920.

HYGIENIC PAINT AND VARNISH CO., LTD., Leeds.—Registered February 11 (by order on terms), £2,250 mortgage, to Sir W. C. Forrest, Leeds; charged on land and premises at Leeds. *Nil. February 13, 1920.

GENERAL PETROLEUM CO. OF TRINIDAD, LTD., London, E.C.—Registered February 9 (by order on terms), charge and covenant to execute mortgage dated August 27, 1920, securing £17,500 and royalty of 10 per cent. on output of oil; also registered February 9 (by order on terms), mortgagee securing £17,850 and mortgage by way of collateral security for same amount, both dated September 1, 1920, all to L. M. Hobson, San Fernando, Trinidad, solicitor; charged on land, mines and estate, &c., in Trinidad. *£875 and £17,000. January 14, 1921.

NATIONAL GLASS CO., LTD., London, E.C.—Registered February 9, £1,000 (not ex.) mortgage, to Lloyds Bank Ltd.; charged on premises at Canning Town. *Nil. May 26, 1920.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

JONES, P. J., York Cottage, Wyver Lane, Belper, chemist. £10 9s. January 4.

LONGMAN, J. H., Rocky Knapp, Dorchester Road Weymouth, chemist. £16 0s. 7d. January 17.

CLOUGH, J. B., 476, St. Helen's Road, Bolton, wholesale druggist. £47 4s. January 12.

HAYES, P. W., 7, Harland Street, Fulwood, Preston, chemist. £30 3s. January 12.

SUTCLIFFE, A., Stone Hill, Broadley, Rochdale, chemist. £23 3s. January 12.

JUBB, R., 150, Devonshire Road, Chiswick, chemist. £26 3s. January 12.

HUTCHEON, J., 2, Alma Street, Northampton, consulting chemist. £23 16s. 2d. January 13.

JAMES, H. P., Medical Hall, Tudor Square, Tenby, chemist. £15 14s. 1d. January 12.

New Companies Registered

The following have been prepared for us by Jordan & Sons, Ltd., company registration agents, 116 and 117, Chancery Lane, London, W.C.2:—

BONELL & CO., LTD., Elbion Works, Agard Street, Derby. Manufacturing chemists and wholesale druggists. Nominal capital, £2,000 in 2,000 shares of £1 each. Directors: E. B. Turner, H. Turner. Qualification of directors, one share.

EASTERN PETROLEUM & FINANCE CO., LTD. To acquire oil, petroleum and mineral-bearing lands, and turn same to account. Nominal capital, £1,500,000 in 1,500,000 shares of £1 each. Minimum subscription, seven shares. Directors to be appointed by subscribers. Qualification of directors, 200 shares. Remuneration of directors, £350 each; chairman, £550.

E.N.O.T., LTD. Manufacturers and merchants in technical, similar articles, &c. Nominal capital, £1,500 in 1,500 shares of £1 each. Directors to be appointed by subscribers. Subscribers: E. X. Rohdoux, G. L. Borradaile.

HALL (L. C.), LTD. Chemists and druggists. Nominal capital, £1,000 in 1,000 shares of £1 each. Directors: C. W. W. Hipperson, L. C. Hall. Qualification of directors, one share.

LLOYD'S COMPOSITION CO., LTD. Paint and varnish manufacturers. Nominal capital, £2,000 in 2,000 shares of £1 each. Directors: J. W. Adamson, J. D. Richardson, J. W. E. Murray, J. W. Murray. Qualification of directors, £100.

WILLIAMS (ROWLAND) & CO., LTD. Oil and grease merchants, general produce brokers and commission agents. Nominal capital £10,000 in 10,000 ordinary shares of £1 each. Directors: R. Williams, E. Williams, H. E. Williams. Qualification of directors, £500.

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PUBLISHER'S ANNOUNCEMENT

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